DGUS_SDK User Guide_V5.1

Beijing DWIN Technology Co., Ltd.

Contents

1. DGUS_SDK Instruction

1.1 Operation of DGUS_SDK

(1) DGUS (DWIN Graphical Utility Software) is an intelligent GUI design software for DWIN DGUS LCM with K600+ kernel. As be helpful to interface of display design faster than ever, diversified display effects can be achieved easily and rapidly with much less programming. The variables in use are defined by software DGUS_SDK v5.1 that is accessed by controller via address. All parameters and images can be downloaded via SD card which stores related .bin files to make your design into real application.

(2) Install DGUS_SDK_V5.1:

Unzip DGUS_SDK_V5.1.zip, and click DGUS ToolV5.1.exe to run it.

(.net Framework 2.0 is required to run the software).

(3) Variable Definition

✧ **VP (Variable Pointer):** The addresses of variables in variable SRAM (56KB). Users can set buttons with defined VP, to change the value in this address and display contents corresponding with the value in VP address.

✧ **SP (Stack Pointer):** the address of definitions, starting address of description data of variables. Change the value in particular address to modify variable properties. Take <WordArt> function as example.

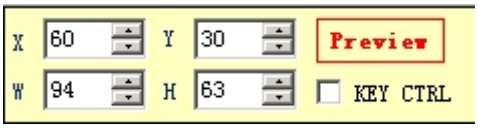
Add.		Definition	Data Length	Description
0x00		0x5A03	2	
0x02		*SP	2	Stack pointer, default setting is 0xFFFF.
0x04		0x0007	2	The whole process length (in terms of words).
0x06	0x00	*VP	2	Variable pointer.
0x08	0x01	X,Y	4	Top-left coordinate of text, left aligned.
0x0C	0x03	Icon0	2	Icon ID corresponding to 0, the sequence is “0123456789-.”.
0x0E	0x04:H	Icon_Lib	1	Address of icon file.
0x0F	0x04:L	Icon_Mode	1	ICON display mode. 0x00: transparent, others: opaque.
0x10	0x05:H	Int_Num	1	Length of integer digits.
0x11	0x05:L	Dec_Num	1	Length of decimal digits.
0x12	0x06:H	VP_Data_Mode	1	0x00: integer (2 bytes), 0x01: long integer (4 bytes).

E.g.: If SP valued as 0x5000 for WordArt variable, VP parameter will be saved in the ADDRESS of 0x5000. Variable position parameters will be saved in 0x5001-0x5002

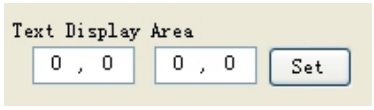
(4) If you need to handle with icons, please drop icon files into Icon Generator to make icon file running in DGUS correctly.

(5) How to select area for buttons & variables.

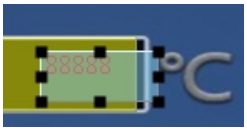
A. Input coordinates directly.



or



B. Drag the button/variable with mouse.



(6) Define SP address for variables.

SP defines the description of variable settings; to reduce overlap of SP address is necessary. There is overlap judging embedded, Configuration files won't be created with failure message when it comes an overlap of SP address.

(7) Import existing DGUS config. files into new project.

A. Create a new project.

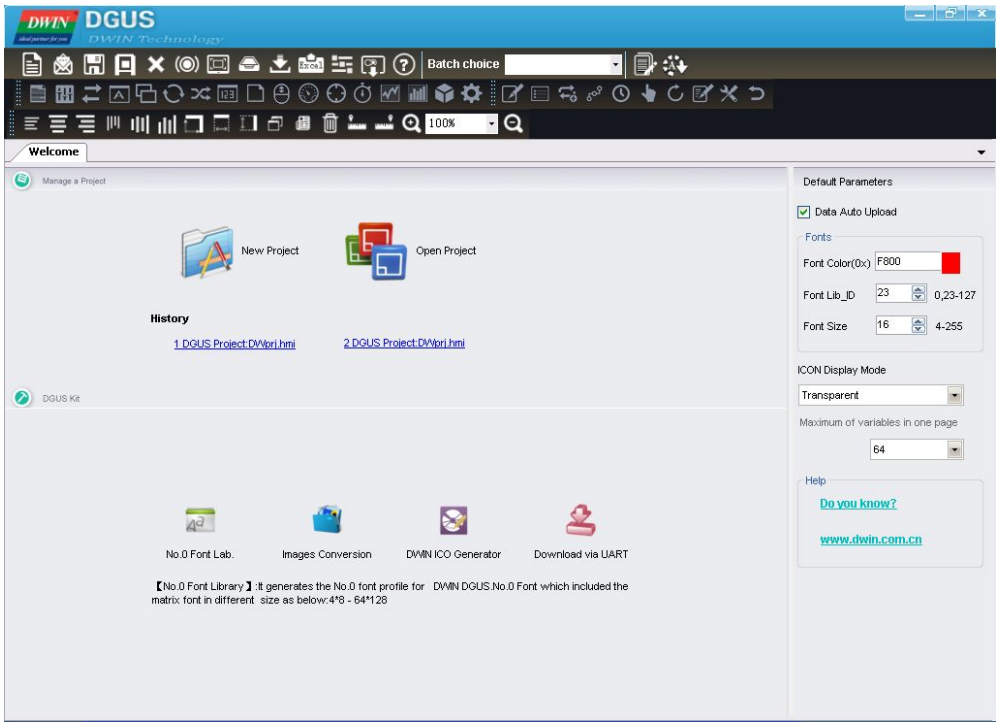
B. Add pictures.

C. Import config files.

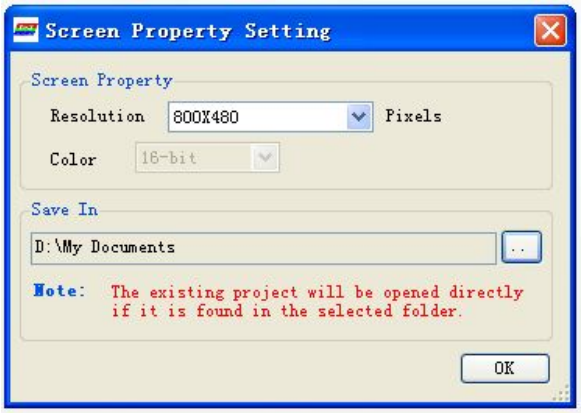
D. Copy icon files into <DWIN_SET> folder.

Note: Frame header is self-defined by users. In this document, A5 5A is taken as frame header for instance.

1.2 Main Interface of DGUS_SDK_V5.1



a) Click <New Project> to activate the window below:



b) Select resolution and path for your project.

Screen Property Set.

E.g. for:

DMT80480T070_06WT.

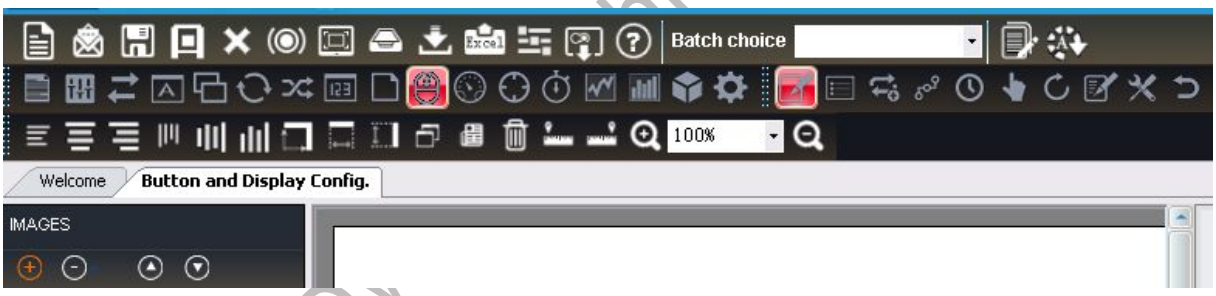
Color T: 16bit.

Resolution 80480: 800x480.

Navigation Bar:

New	Create a new project.
Open	Open an existing project (.hmi file).
Save	Save the current project.
Save As	Save the current project in a new folder.
Close	Close the current project.
Variables Preview	Preview buttons & variables
Resolution	Modify resolution of project.
Generating Configuration file	Modify system configuration and save the settings in config.txt. Refer to illustration below.
Import Config.	Import existing config. files to the current project.
Export Variables	Generate <TouchConfig.xls> and <DisplayConfig.xls> for quick view of buttons & variables.
System Properties	Modify system properties and save the settings in config.txt. Refer to illustration below
DGUS Configuration File Download	Download <13Touch_Control_Config.bin>, <14Variable_Config.bin>, and the image; debug commands via serial port.
Help	Help documents.
Align Left	Align the selected buttons and variables to left.
Align right	Align the selected buttons and variables to right.
Align Top	Align the selected buttons and variables to top.
Align bottom	Align the selected buttons and variables to bottom.
Auto Width	Adjust the selected buttons & variables at same width.
Auto Height	Adjust the selected buttons & variables at same height.
Vertical centered	Adjust the selected buttons & variables at the vertical center.
Horizontal centered	Adjust the selected buttons & variables at the horizontal center.
Copy	(Ctrl + C)**:** copy
Paste	(Ctrl + V)**:** paste
Delete	(delete)**:** delete
Front	Place the button or variable at front layer.
Back	Place the button or variable at backward layer.
SP Address Setting	Set SP for variables.
Variables Preview	Preview buttons & variables
Show Text	show the names of buttons & variables or not.

Reference：*Inputted data will be sent via serial port only when both <TPSAUTO> in System Config. Window and <Data Auto Upload> settings in buttons properties are ticked.*



Tool Bar:

Switching between "Touch Config" & "Variable Config" & Edit Tools using Navigation bar, or shortcut key F2, F3,F4.

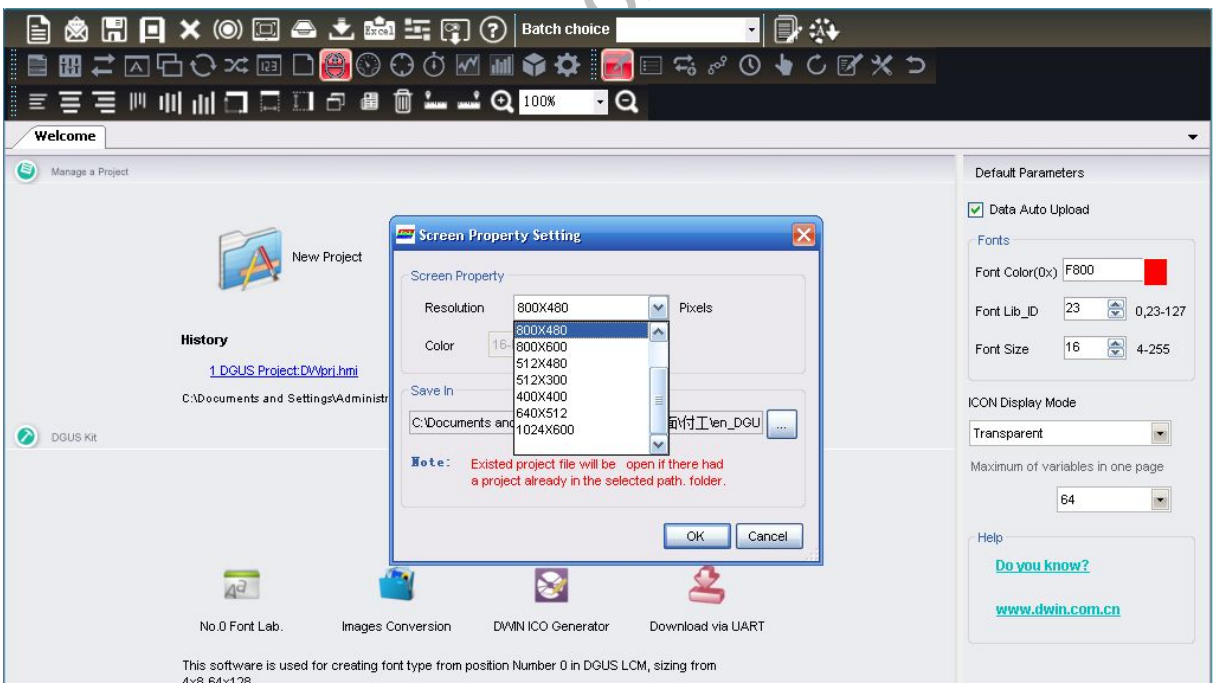
2. Basic Steps for DGUS_SDK Operation

2.1 Create a new project

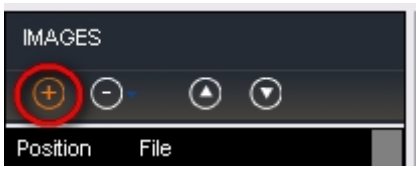
2.1.1 Start a new project

Open the DGUS_SDK_V5.1--------> Click “New Project” button to start a new project.

2.1.2 Select corresponding resolution and save the path



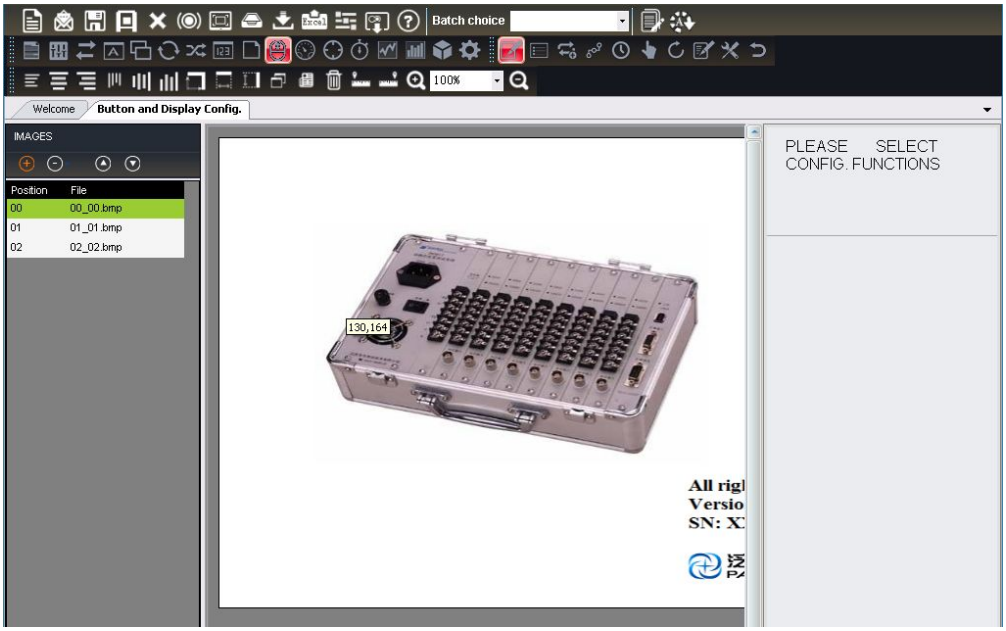
2.1.3 Add images



Images indicating here are what to be displayed as background with ".bmp" format required.

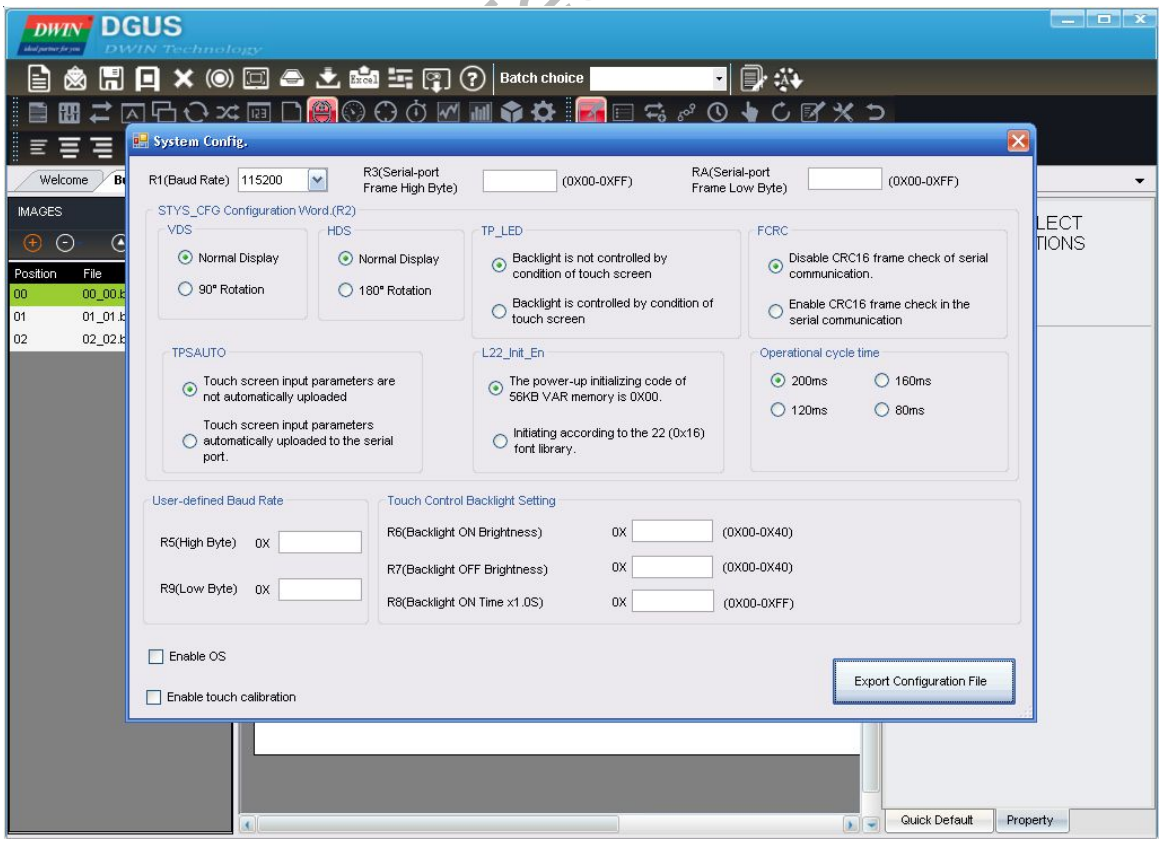
Image naming rules: ID + Name. bmp (name as optional)

For example, "0_Data Input.bmp" or "0.bmp"

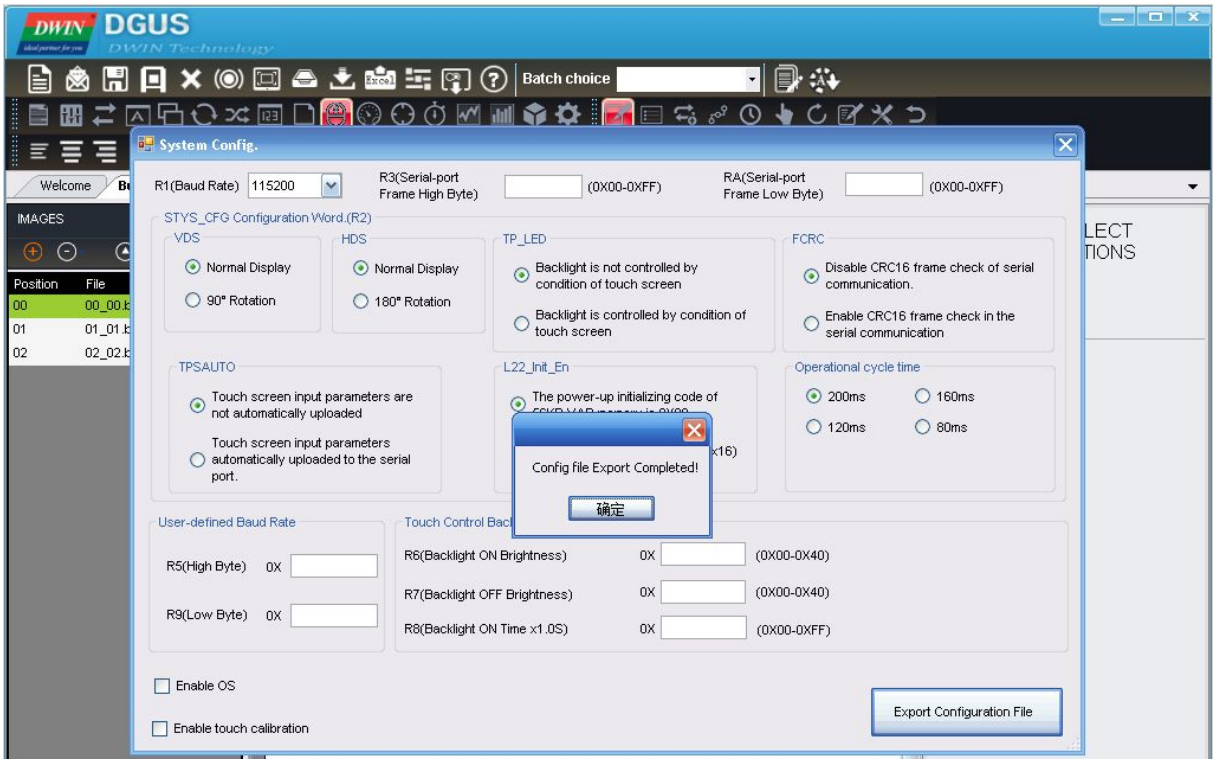


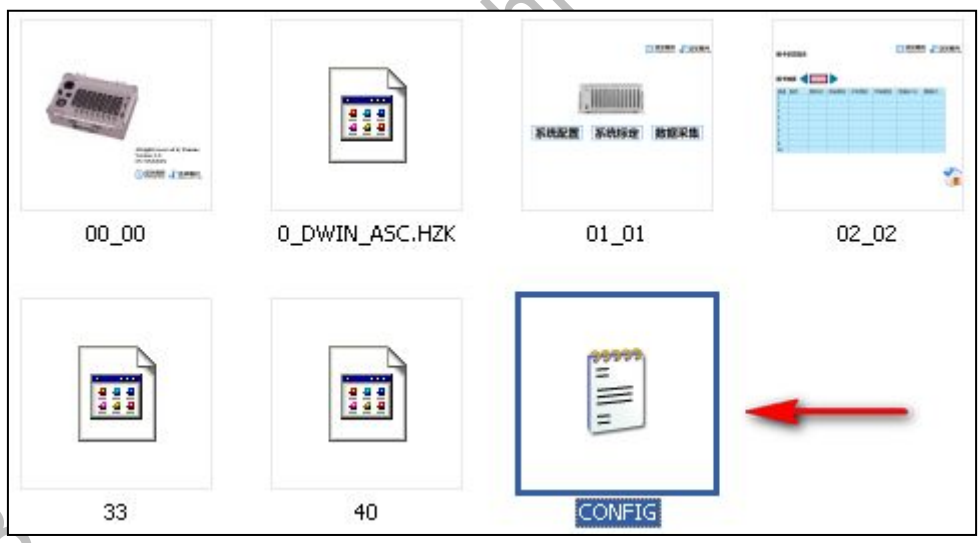
2.1.4 Create a CONFIG.TXT file for setting system parameters

Step into setting such system as baud rate, backlight, as well as cycle time etc.



Export Configuration File – "CONFIG. txt"





For the value and functions of each parameters, please refer to the chapter 1.2 of the DGUS Dev. Guide_V5.1—CONFIG. TXT

Name of Parameter Register	Range	Description
R0	Depends	Module driver mode, unnecessary for modification which may cause errors. Do not configure it.
R1	0x00-0x11	Baud rate setting, 0x00-0x10 matchup with 1200bps —921600bps. R1 | 0x00 | 0x01 | 0x02 | 0x03 | 0x04 | 0x05 | 0x06 | 0x07 | 0x08 Baud rate | 1.2K | 2.4K | 4.8K | 9.6K | 19.2K | 38.4K | 57.6K | 115.2K | 28.8K R1 | 0x09 | 0x0A | 0x0B | 0x0C | 0x0D | 0x0E | 0x0F | 0x10 | 0x11 Baud rate | 76.8K | 62.5K | 125K | 250K | 230.4K | 345.6K | 691.2K | 921.6K | Defined
R2	0x00-0xFF	SYS_CFG configuration byte. Refer to the following table.
R3	0x00-0xFF	UART_SYNC_H, High byte of frame header.
R4		Module driver mode, unnecessary for modification which may cause errors. Do not configure it.
R5	0x00-0xFF	When R1=0x11, high byte of baud rate configuration. R5:R9=625000/user-defined baud rate. E.g.: set baud rate as 10000bps, R5:R9=6250000/10000=625=0x0271, R5=0x02, R9=0x71.
R6	0x00-0x40	Brightness of backlight.
R7	0x00-0x40	Brightness of backlight in sleep mode.
R8	0x01-0xFF	Time before sleep mode. activation
R9	In Flux	When R1=0x11, low byte of baud rate configuration.
RA	0x00-0xFF	UART_SYNC_L, Low byte of frame header.
RC	In Flux	AUX_CFG Configuration. Refer to the following table.
All parameters should be 2-digit hexadecimal numbers, for example 0A indicates 10 in decimal base. Two bytes are must, for example 00 is not allowed to write as 0		

➢ **R2 (SYS_CFG configuration Byte)**

Bit	Ratio	Definition	Description
.7	0x80	VDS	0=Normal display. 1=90° Rotation.
.6	0x40	HDS	0=Normal Display. 1=180° Rotation (upside down).
.5	0x20	TP_LED	0=Brightness can't be changed via screen clicking 1=Brightness can be changed via screen clicking, the parameters set up in R6, R7,R8
.4	0x10	FCRC	0=Disable CRC16 checksum in the serial communication. 1= Enable CRC16 checksum in the serial communication
.3	0x08	TPSAUTO	0=Disable auto-upload of key code or data. 1=Enable auto-upload of key code or data.
.2	0x04	L22_Init_En	0=Initialize 56KB access variable data to 0x00. 1=Initialize 56KB access variable data from 22*.bin.
.1	0x02	FRS1	Set the cycle of DGUS, the smaller number will shorten response time for variable display, but reduce the efficiency of data processing.
.0	0x01	FRS0	

Cycle	80mS	120mS	160mS	200mS
FRS1	1	1	0	0
FRS0	1	0	1	0

For the resolution 1024*768, recommended set the cycle upon 120mS.
The cycle influence the speed of Animation Icon display.

If the frame header is set as R3=5A RA=A5, please use the software "Serial debugging assistant sscom32 " sending command below for verifying all images works fine.

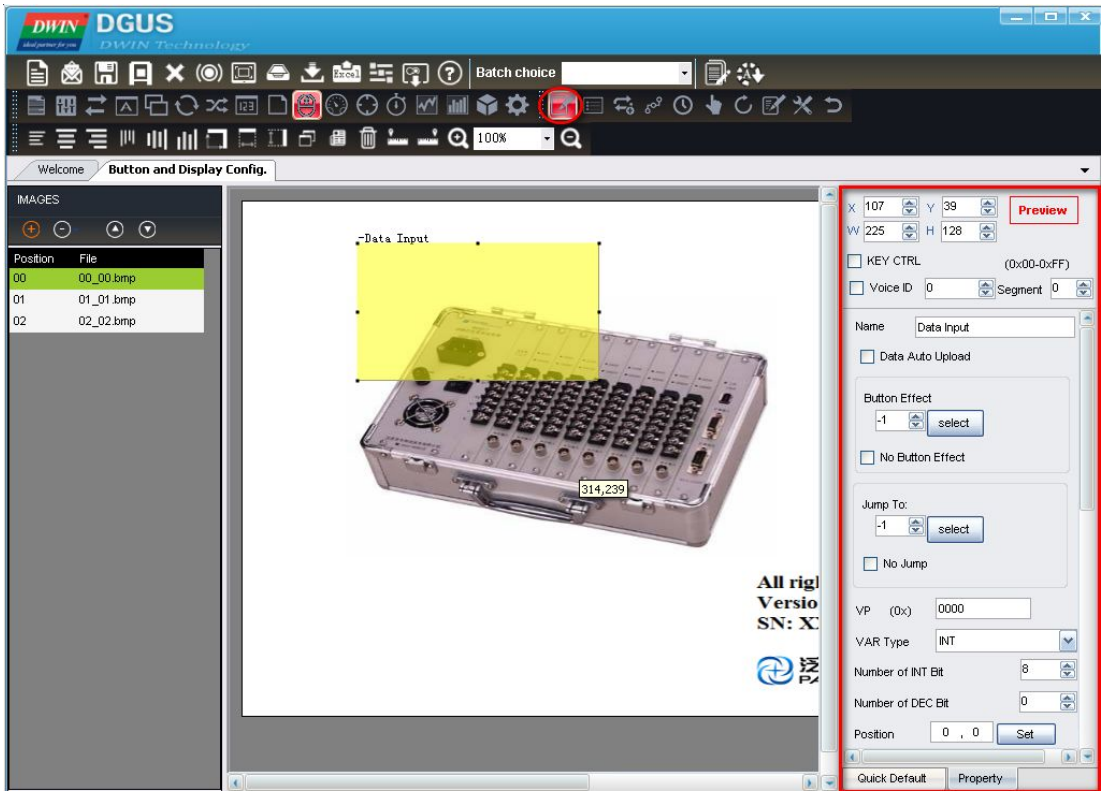
5A A5 04 80 03 00 01(00 01 signify images switching to No1.)

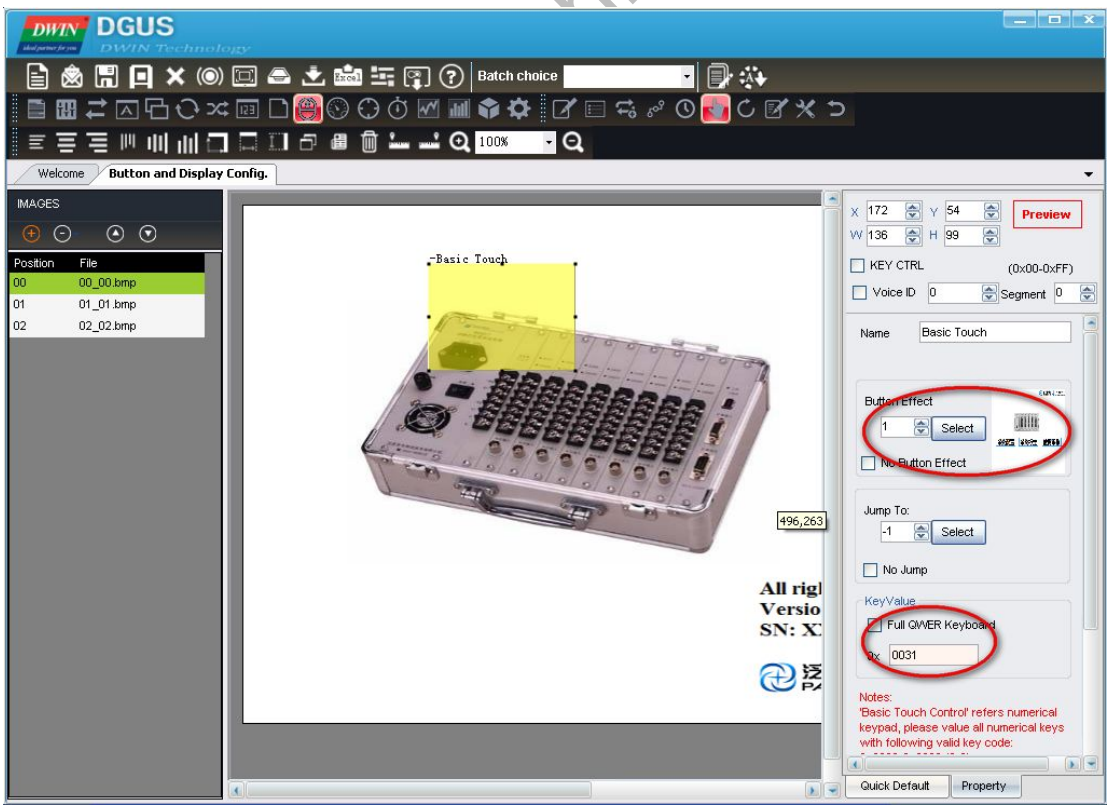
Later, check if images No1 switched successfully. (format must be .bmp naming started from"00").

There are config.txt failed or com port out of work in the event of images switch failure. Please affirm parameter for config.txt again including frame header, baud rate etc.

2.2 Configure touch functions

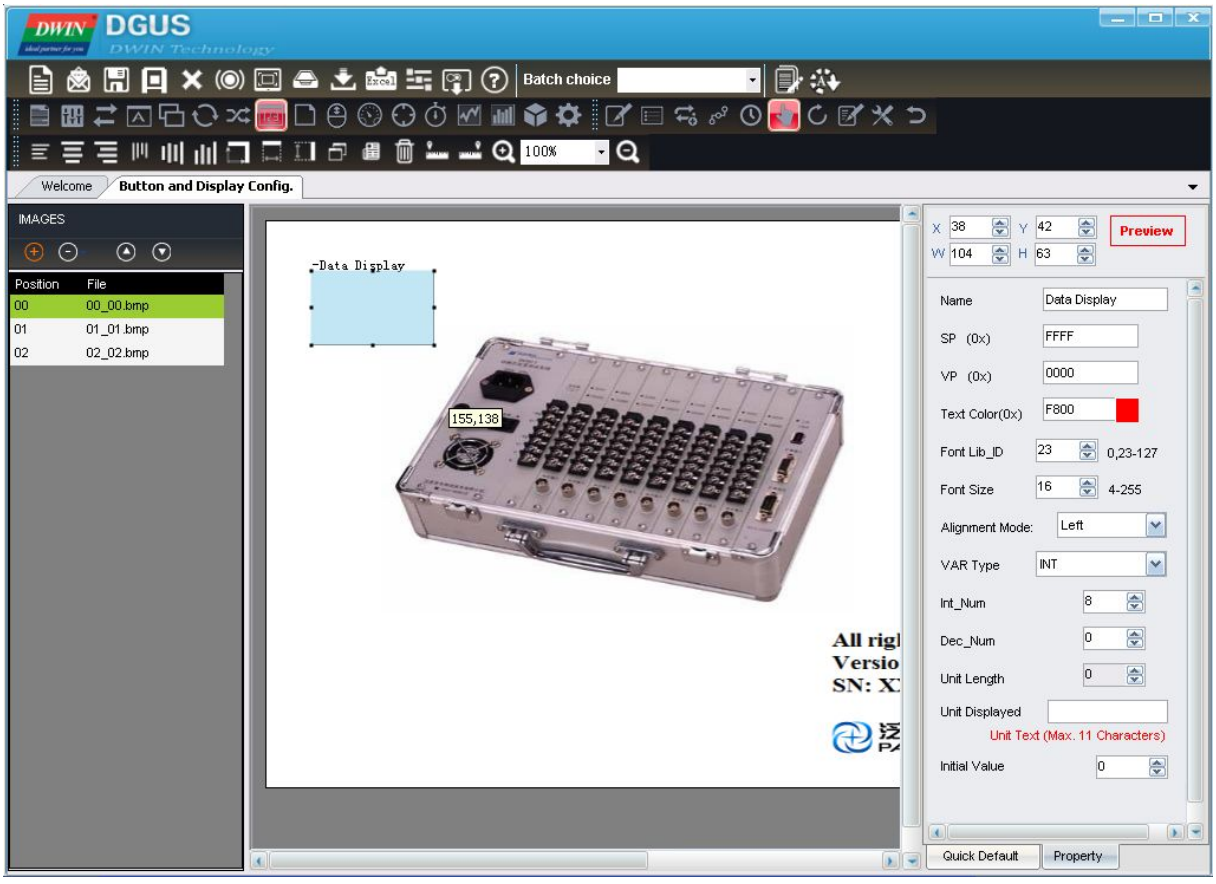
Select the "Touch Config" from pull-down menu-------> Add touch function, as "Data Input" -------> Drag a square on your button as follow yellow area -------> Set the properties, such as button effect, key value, etc.





2.3 Configure variable display

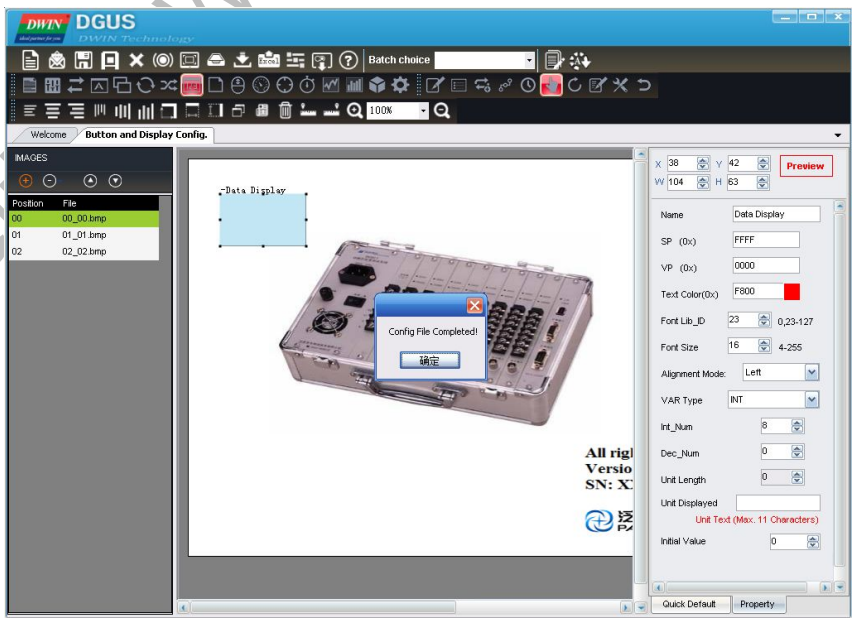
Select the “Variable Config” from pull-down menu -------> add the display function, as “Data Variable” ------->Drag a blue square on area, the variable will be displayed based on the upper-right coordinates.--------> Set the properties of variable as font color, font ID.

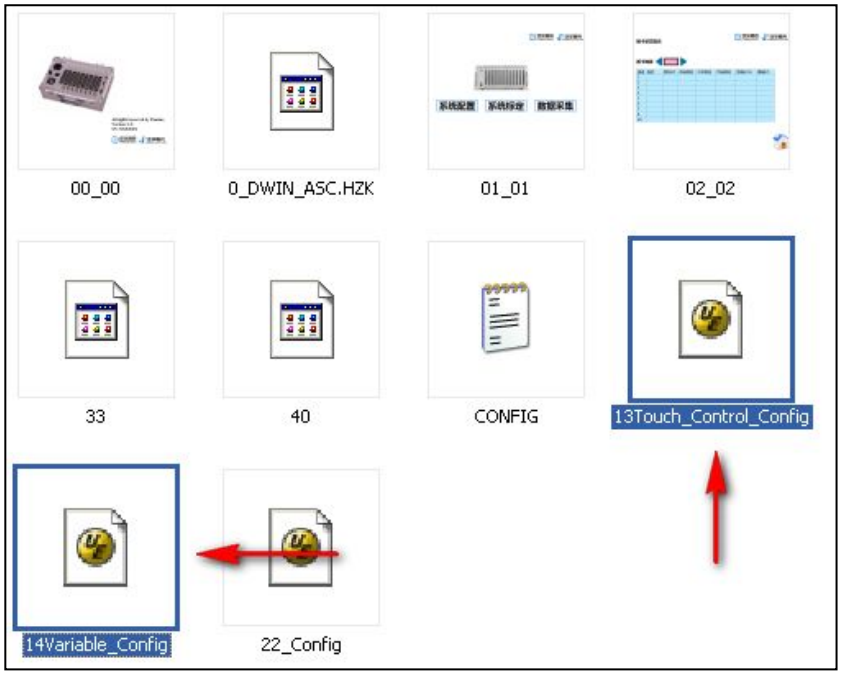


2.4 Create configuration files

Click the “Generating Configuration File” button, it will create a touch control configuration file and a variable configuration file. Their default file names are “13Touch_Control_Config.bin” and” 14Variable_Config.bin “which cannot be renamed, or the project can’t be opened properly.

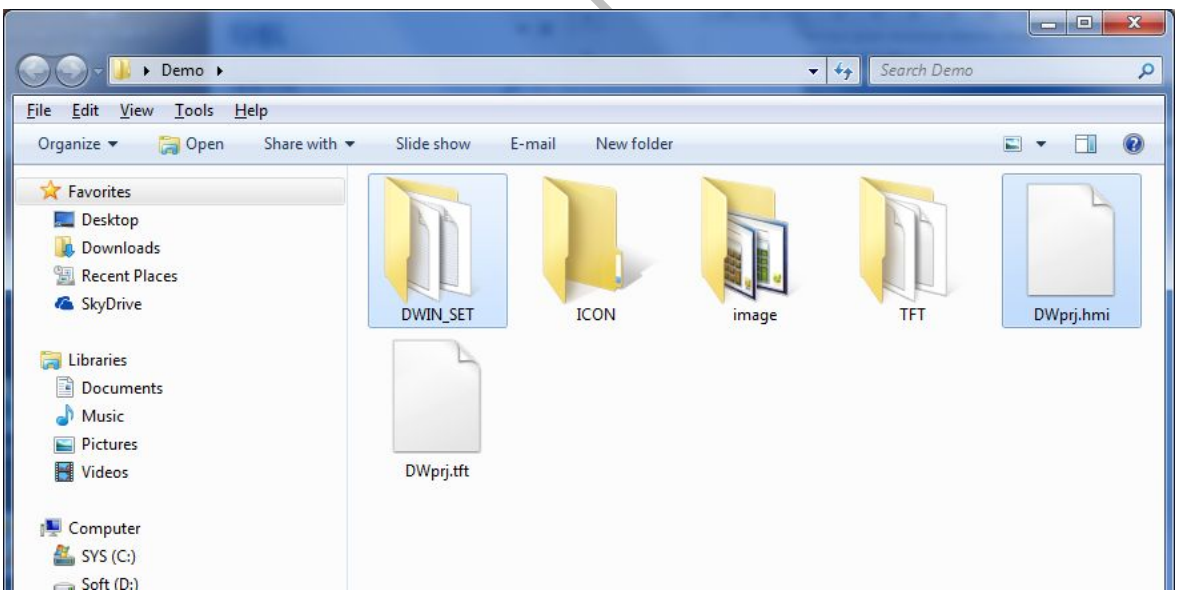
Please note that 13&14 bin file must be dropped in corresponding DWIN_SET folder if file downloaded via UART, otherwise pop-up red warning will show up warning correct file are not found.





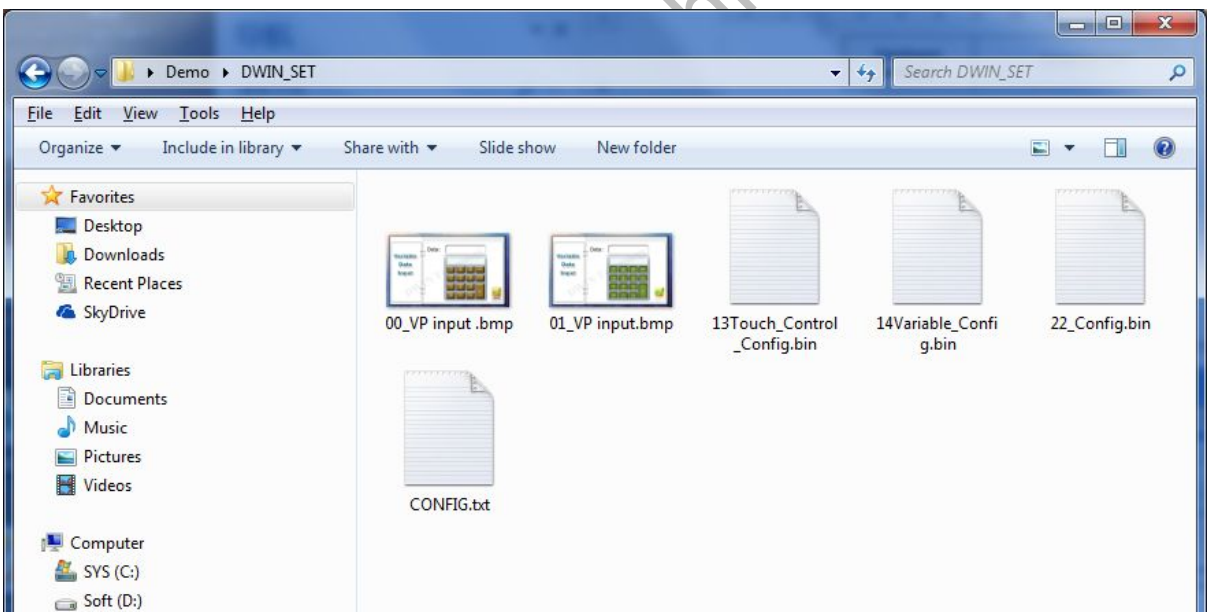
2.5 Download

When you completed above steps, it will create a DWIN_SET folder and a project named DWprj.hmi in the path you selected before.



The DWIN_SET folder includes as follow:

File Type	Naming Rule	Example	Description
Pictures	Picture ID+ (optional) file name.BMP	00_starting page.BMP	24-bit BMP pictures with same resolution of DWIN module are required
Fonts	Font ID+ (optional) file name.BIN/DZK/HZK	32_ASCII. DZK	Generated by the Font Generator
Icon Library	Icon file ID+ (optional) file name.ICO	41_iconlibrary. ICO	Generated by DWIN Toolbox "DWICON"
Default ASCII	0*.HZK	0_DWIN_ASC.HZK	Generated by DWIN Toolbox "No.0 font library".
Touch configuration	13*.BIN	13_touch configuration file.BIN	Generated by DWIN DGUS software
Variable configuration	14*.BIN	14_variables configuration file. BIN	Generated by DWIN DGUS software
Variables Initialization	22*.BIN	22_Initialization.BIN	
User Code	23*.BIN	23_Water_Treatment.BIN	
Hardware settings	CONFIG.TXT	CONFIG.TXT	



Copy the DWIN_SET folder into the SD card root directory ------> Powered on DGUS LCM------> Insert SD card into the slot of LCM, the configuration files will be downloaded automatically.

Note: During downloading, don't turn off the LCM, the screen will blink to blue then back to the first image after completion

3. Main Functions of DGUS_SDK

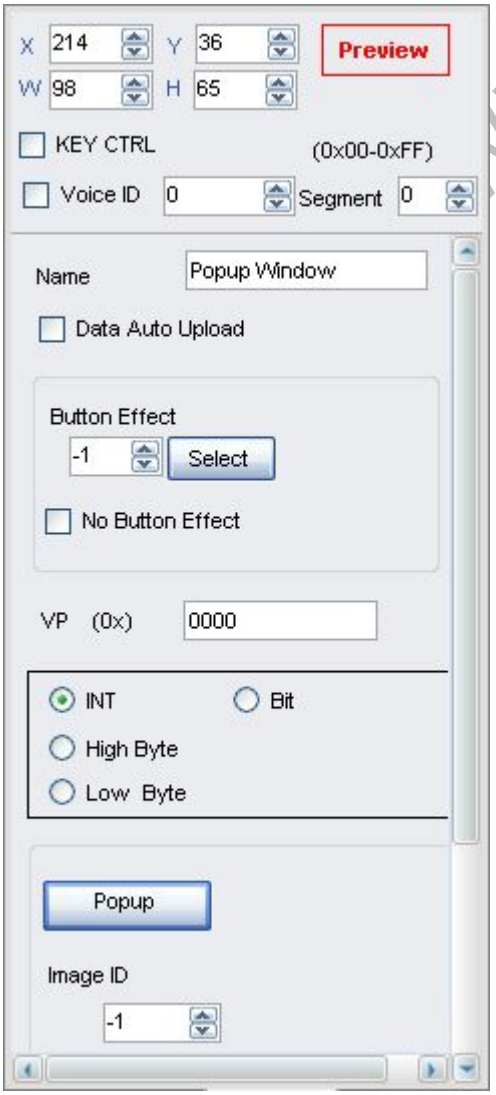
Touch Config： users can use DGUS_SDK software to add buttons on screen, including Popup Window, Variable Data Input, Incremental Adjustment, Slider Adjustment, RTC Setting, Touch Control, Return Key Code, and ASCII Input. Buttons are shown as yellow rectangles in DGUS_SDK_V51. Users can also add press effect for buttons.

Variable Config： users can use DGUS_SDK to add variables on screen, including Variable Icon, Animation Icon, Slider, WordArt, Image Animation, Icon Rotation, Data Variable, Text Display, RTC Display, Analog Clock Display, Dynamic Trend Curve Display, Table Display, and Basic Graphic Display, Bit Icon, Timer Variable. Variables are shown as light-blue rectangles in DGUS_SDK_V51.

Parameter settings: users can use <System Properties> to adjust parameter settings of DGUS module. Parameter with "0x" in front should be filled with hex numbers.

3.1 Touch Config.

3.1.1 Popup Window



Selected Area: selected button area.

Preview: preview button effect.

Name: name this button for viewing it in .xls (Excel) file.

Data Auto Upload: after pressing the button, key code auto sent to serial port.

Button Effect: set picture ID for touching effect, -1: null.

VP: variable pointer.

VAR Type:

INT: write key code in VP address (word).

High Byte: write low byte of key code in high byte of VP.

Low Byte: write low byte of key code in low byte of VP.

Bit: write data from last bit of key code into designated bit of VP address. (0x10 corresponds to VP.0, 0x1F corresponds to VP.F).

Popup Window: set window picture ID and window area.

Image ID: image ID of window picture.

Cut Area: cut area in image ID.

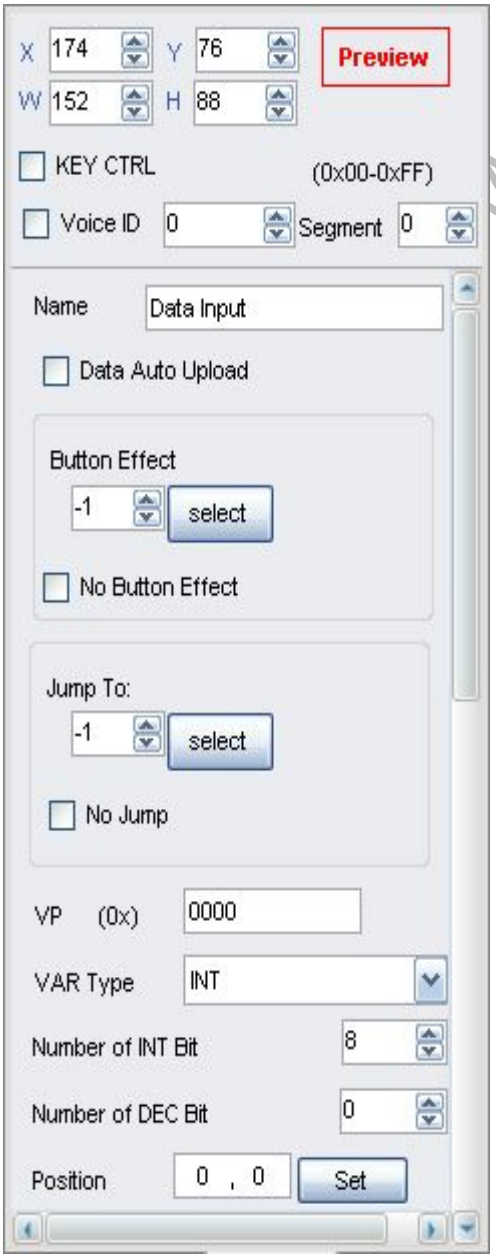
Paste Position: position of window on current screen.

Note: Only <Touch Control> buttons will work on popup window.

Illustration of button <Popup Window>:

Click <Stop> button - Window pops up - Select YES/NO.

3.1.2 Variable Data Input



Selected Area: selected button area.

Preview: preview button effect.

Name: name this button for viewing it in .xls file.

Data Auto Upload: after pressing the button, key code auto sent to serial port.

Button Effect: set picture ID for touching effect, -1: null.

Jump To: switch to a new picture after pressing.

VP: variable pointer.

VAR Type:

INT: integer.

LONGINT: long integer.

High byte: high byte in VP address.

Low byte: low byte in VP address.

Number of INT Bit: length of integer digits.

Number of DEC Bit: length of decimal digits.

Position: data position when typing.

Font Color: data color when typing.

Font ID: address of ASCII font file.

Font Size: horizontal pixel numbers.

Cursor Color: white/black cursor.

Display Mode: masked by (*)/direct display.

Define Keyboard:

Set the keyboard picture ID and the keyboard area.

Image ID: image ID of the keyboard area.

Cut Area: cut area in image ID.

Paste Position: position of the keyboard on current screen.

Enable VAR Input Limitation:

Set limits for inputting numbers.

Notes: Only <Touch Control> buttons will work on keyboard: 0x00F1 (Confirm), 0-9 corresponds to 0x0030 - 0x0039, 0x00F0 (Cancel), 0x00F2 (Backspace), 0x002D (+/-), 0x002E (.).

Ignore decimal point while setting range restriction for return value. E.g.: the setting is 3 integer bits and 2 decimal bits, and then the top limit is 10000, rather than 100.

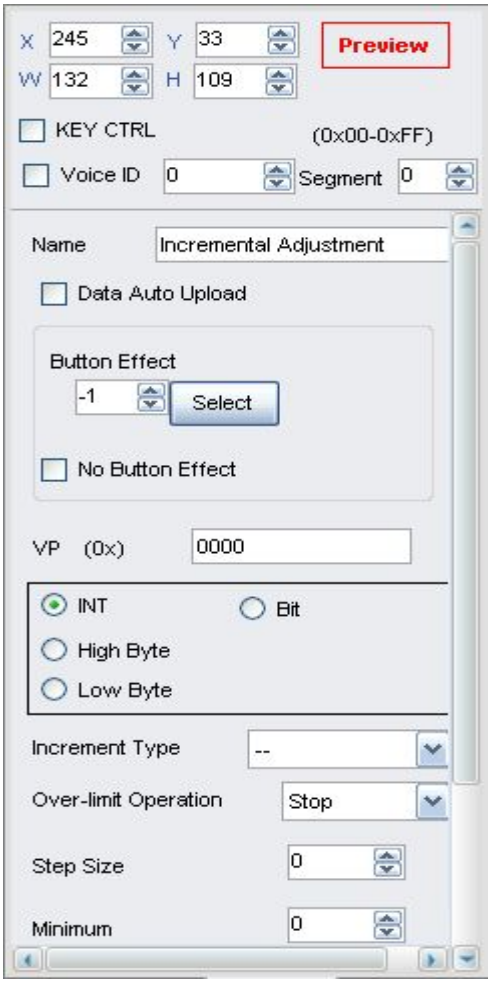
Inputted data can be displayed by <Data Variable>, <WordArt> etc.

Illustration of button <Variable Data Input>:

Click text – Keyboard pops up – Type data – OK.

Click <Cancel> to interrupt input.

3.1.3 Incremental Adjustment



Selected Area: selected button area.

Preview: preview button effect.

Name: name this button for viewing it in .xls file.

Data Auto Upload: after pressing the button, key code auto sent to serial port.

Button Effect: set picture ID for touching effect, -1: null.

VP: variable pointer.

VAR Type:

0x00: integer.

0x01: high byte in VP address.

0x02: low byte in VP address.

0x10 – 0x1F: adjust value in designated bit of VP address. (0x10 corresponds to VP.0, 0x1F corresponds to VP.F) Step Size must be 0 or 1.

Adjustment Method: ++/--.

Over-limit Operation: stop/ cycle.

Step Size: set step size for +/- buttons.

Min. Value: minimum value for adjustment.

Max. Value: maximum value for adjustment.

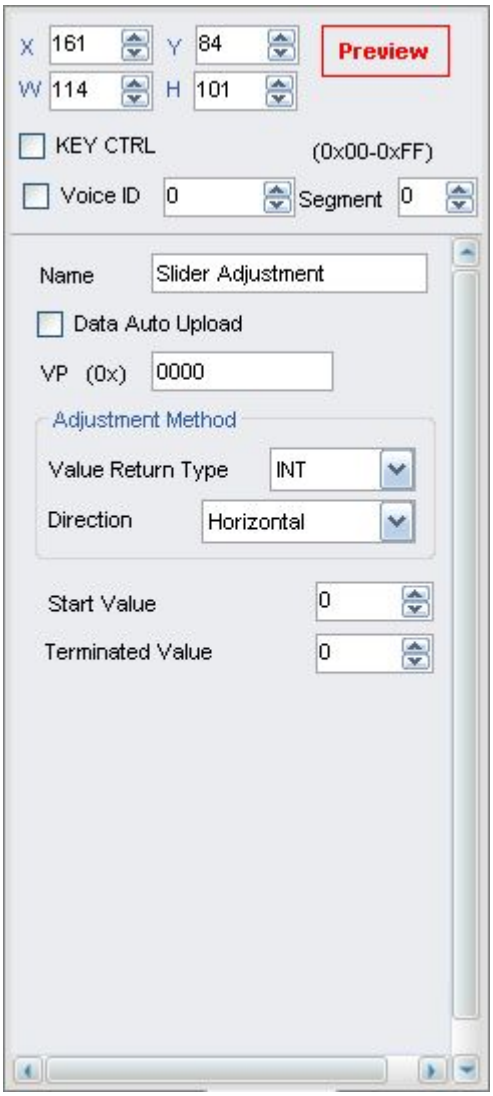
Adjusted data can be displayed by <Data variable>, <Icon variable> and <WordArt> etc.

Illustration of button <Incremental Adjustment>:

Click <+> or <-> to adjust corresponding value.

Hold the button to adjust continually.

3.1.4 Slider Adjustment



Selected Area: selected button area.

Preview: preview button effect.

Name: name this button for viewing it in .xls file.

Data Auto Upload: after pressing the button, key code auto sent to serial port.

VP: variable pointer.

Value Return Type:

0x00: integer.

0x01: high byte in VP address.

0x02: low byte in VP address.

Direction: horizontal/vertical.

Start Return Value:

The value corresponding to left/top side of slider.

Terminated Value:

The value corresponding to right/bottom side of slider.

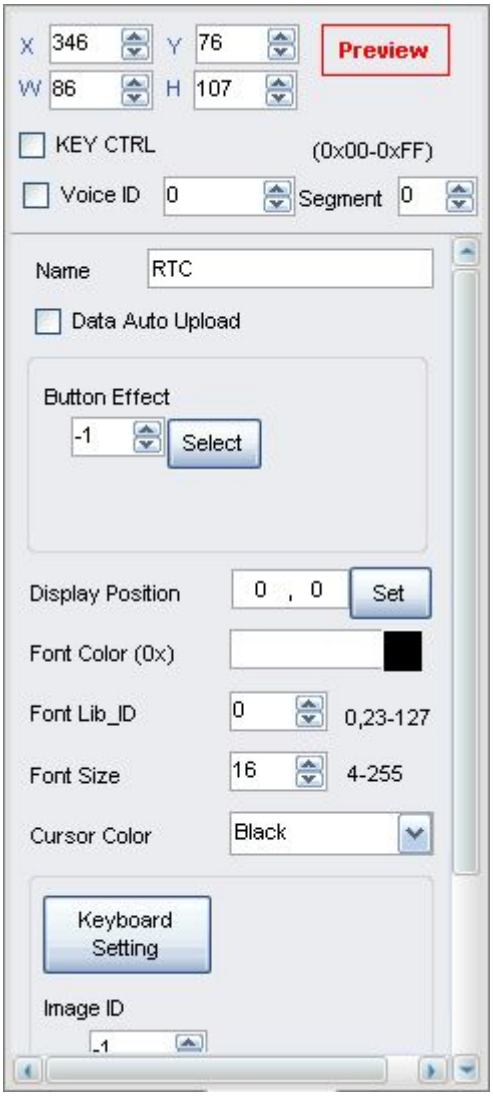
This function is only for making touching area for slider. To display it, please use <Slider display> function.

Adjusted data can be displayed by <Data variable>, <Variable icon> etc.

Illustration of button <Slider Adjustment>:

Hold the button over 0.5 second and slide the slider to modify number in the right, the value will also be changed.

3.1.5 RTC



Selected Area: selected button area.

Preview: preview button effect.

Name: name this button for viewing it in .xls file.

Data Auto Upload: after pressing the button, key code auto sent to serial port.

Button Effect: set picture ID for touching effect, -1: null.

Display Position: data position when typing.

Font Color: data color when typing.

Font Lib_ID: address of ASCII font file.

Font Size: horizontal pixel numbers.

Cursor Color: white/black cursor.

Keyboard setting:

Set the keyboard picture ID and the keyboard area.

Image ID: image ID of keyboard area.

Cut Area: cut area in image ID.

Paste Position: position of the keyboard on current screen.

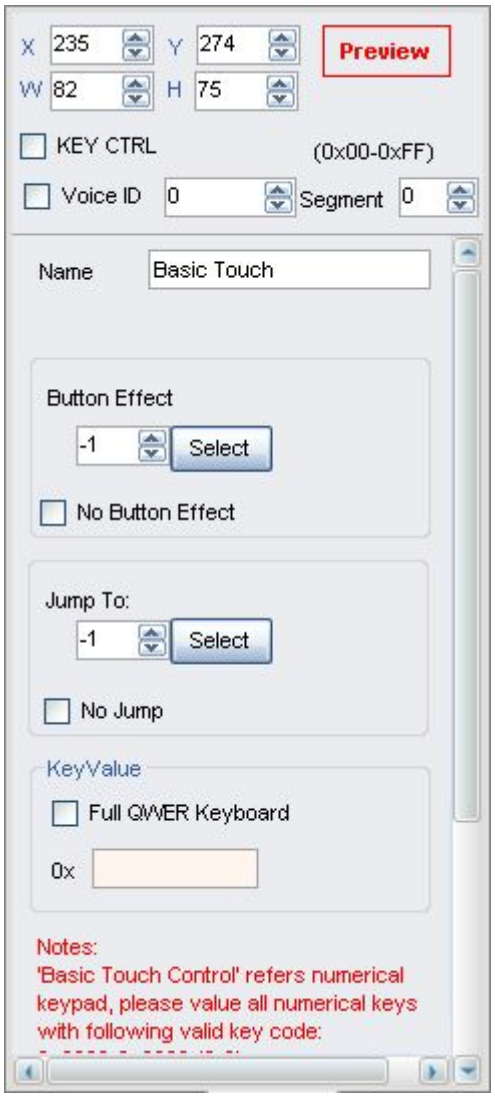
Notes: A keyboard setting is the same as <Data Input>.

Use <RTC display> or <Analog clock display> to display current time.

Illustration of button <RTC>:

Click <RTC> button - Keyboard Pops Up - Clock Sets Up the Current Time.

3.1.6 Basic Touch Control



Selected Area: selected button area.

Preview: preview button effect.

Name: name this button for viewing it in .xls file.

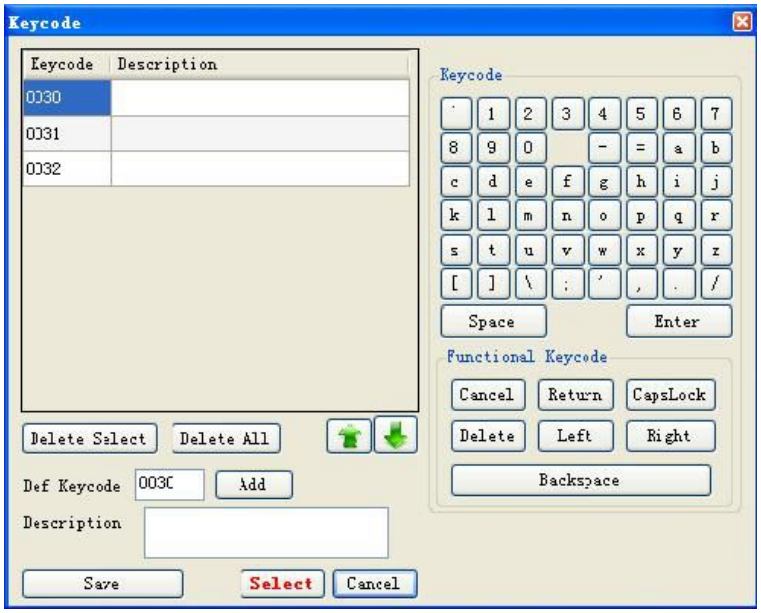
Button Effect: set picture ID for touching effect, -1: null.

Jump To: switch to a new picture after pressing.

KeyValue:

Only <Touch Control> button works on keyboard area.

Valid key code range: 0x0030 - 0x0039 (0-9), 0x002E (.), 0x002D (+/-), 0x00F0 (Cancel), 0x00F1 (Confirm), 0x00F2 (Backspace).



3.1.7 Return Key Code

Selected Area: selected button area.

Preview: preview button effect.

Name: name this button for viewing it in .xls file.

Data Auto Upload: after pressing the button, key code auto sent to serial port.

Button Effect: set picture ID for touching effect, -1: null.

Jump To: switch to a new picture after pressing.

KeyValue: self-defined keyValue for buttons.

VP: variable pointer.

VP Type:

Save in VP address.

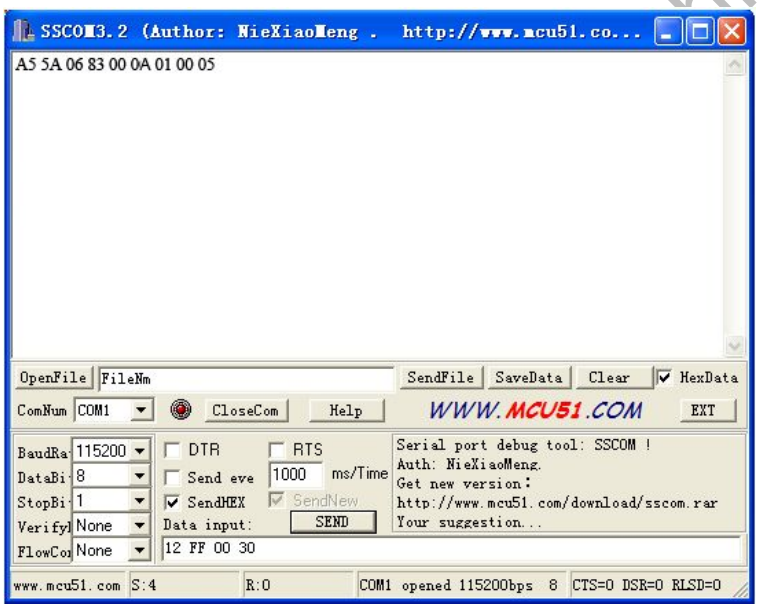
Save in high byte of VP address.

Save in low byte of VP address.

Save in specified bit of VP address.

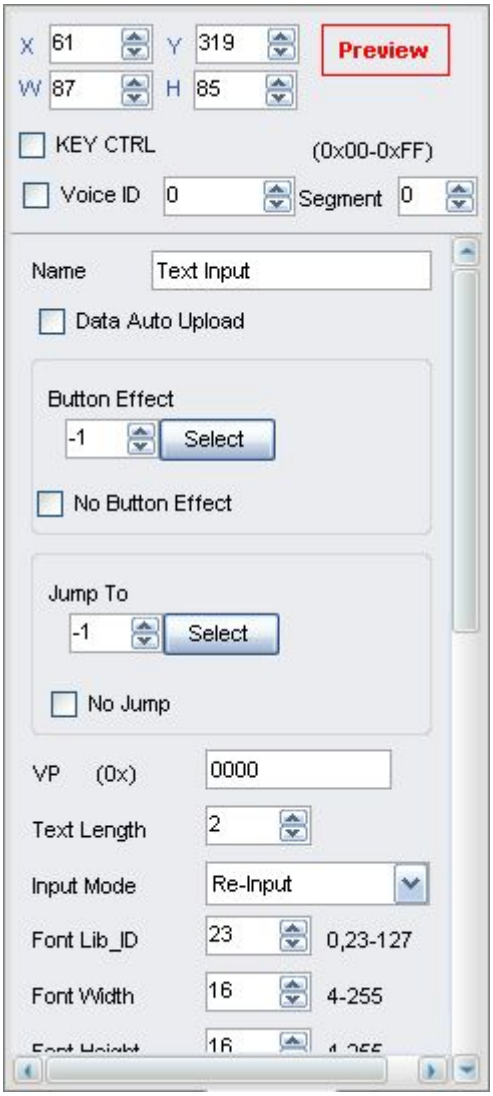
Illustration of button <Return Key Code>:

Set a <Return Key Code> button, of which VP is 0x000A, key value is 0x0005.



DGUS module auto uploads data 0005 to serial port as shown.

3.1.8 ASCII Input



Selected Area: selected button area.

Preview: preview button effect.

Name: name this button for viewing it in .xls file.

Data Auto Upload: after pressing the button, key code auto sent to serial port.

Button Effect: set picture ID for touching effect, -1: null.

Jump To: switch to a new picture after pressing.

VP: variable pointer.

Text Length: length of text, by word, range from 1 to 123.

Input Mode: re-input/ edit text.

Font Lib_ID: address of ASCII font file.

Font Width: horizontal pixel numbers.

Font Height: vertical pixel numbers.

Cursor Color: white/black.

Font Color: data color when typing.

Upload value as typing: tying status upload.

Text Display Area: data position on screen when typing.

Keyboard Displayed in: Current Page/Other Page.

Keyboard Setting:

Set the keyboard picture ID and the keyboard area.

Image ID: image ID of the keyboard area.

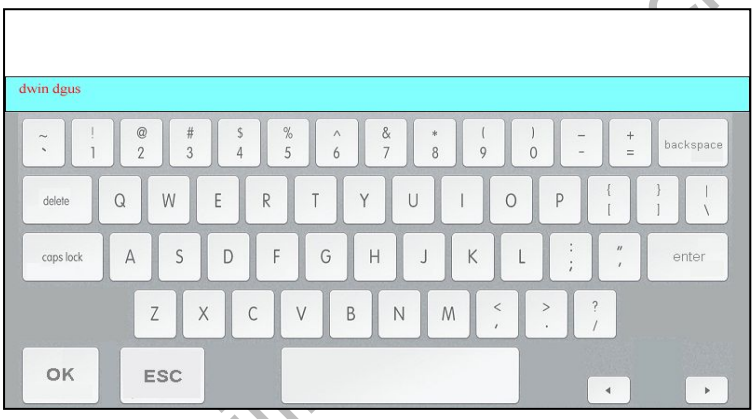
Cut Area: cut area in image ID.

Paste Position: position of the keyboard on current screen.

Note: Create <Touch control> buttons on keyboard to define the key code of the button (0x4161 indicates “A”).

Inputted data can be displayed with <Text display> function.

Illustration of button <ASCII Input>:



3.1.9 Firmware Parameter Settings

Selected Area: selected button area.

Preview: preview button effect.

Name: name this button for viewing it in .xls file.

Data Auto Upload: after pressing the button, key code auto sent to serial port.

Button Effect: set picture ID for touching effect, -1: null.

Jump To: switch to a new picture after pressing.

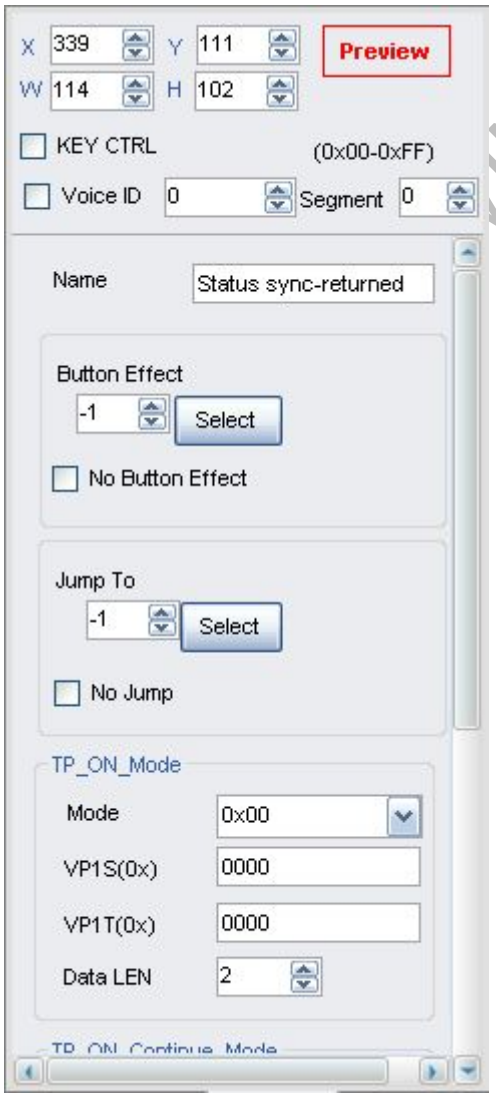
Mode: setup mode.

DataPack: data pack of setup.

Setup Mode

<table>
<tr><th>Mode</th><th>Data Pack</th><th>Description</th><th>Function</th></tr>
<tr><td>0x00</td><td>No</td><td>No</td><td>Transmit data from register to variable SRAM in 0x6F00 to 0x6FFF (low bytes).</td></tr>
<tr><td>0x01</td><td>No</td><td>No</td><td>Transmit data from address 0x6F00 to 0x6FFF in variable SRAM (low bytes) to register and reset module parameters including R1-R3, R5-RA.</td></tr>
<tr><td rowspan="3">0x02</td><td>Tran_Area</td><td>Coordinates of top-left and bottom-right of area.</td><td rowspan="3">Convert designated area to monochrome bitmap (vertical mode) and save the data to designated VP address.
A. Width (Xe-Xs+1) should be even.
B. Height (Ye-Ys+1) should be multiple of 8.
C. VP data format shown as below:
VP: status indicator, refreshed to 0x5555 after operation.
VP+1: horizontal length, by word. (Xe-Xs+1) &0xFFFE/2
VP+2: numbers of data segment. (Ye-Ys+1) &0xFFF8/8
VP+3: bitmap data, with MSB priority.
If the key code automatically upload is enabled (R2.3=1), module will upload message (value in VP address upload to 0x5555) to serial port.
The command is mainly for printing of current screen.</td></tr>
<tr><td>*VP</td><td>VP address for restoring bitmap data.</td></tr>
<tr><td colspan="2"><table>
<tr><td></td><td>X=0</td><td>X=1</td><td>X=2</td><td>X=3</td><td>…</td><td>X=126</td><td>X=127</td></tr>
<tr><td>Y=0</td><td>D0.15</td><td>D0.7</td><td>D1.15</td><td>D1.7</td><td></td><td>D63.15</td><td>D63.7</td></tr>
<tr><td>…</td><td>…</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Y=7</td><td>D0.8</td><td>D0.0</td><td>D1.8</td><td>D1.0</td><td></td><td>D63.8</td><td>D63.0</td></tr>
<tr><td>Y=8</td><td>D64.15</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>…</td><td>…</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Y=15</td><td>D64.8</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td rowspan="2">0x03</td><td>*VP</td><td>Variable pointer.</td><td rowspan="2">Upload data in designated VP address to serial port.
Range of Tx_LEN: 0x0001-0xFFFF.</td></tr>
<tr><td>Tx_LEN</td><td>Length of data to be sent.</td></tr>
<tr><td>0x04</td><td colspan="3">Same function with 0x03, uploading data to COM2 (reserved port).</td></tr>
<tr><td rowspan="2">0x05</td><td>Tran_Area</td><td>Coordinates of top-left and bottom-right of area.</td><td rowspan="2">Convert designated area to monochrome bitmap (horizontal mode) and save the data to designated VP address.
A. Width (Xe-Xs+1) should be multiple of 16.
B. VP data format as shown below:
VP: status indicator, refreshed to 0x5555 after operation.
VP+1: horizontal length, by word. (Xe-Xs+1) &0xFFF0/16
VP+2: numbers of data segment. (Ye-Ys+1)
VP+3: bitmap data, with MSB priority.
If the key code automatically upload is enabled (R2.3=1), module will upload message (value in VP address upload to 0x5555) to serial port.
The command is mainly for printing of current screen.</td></tr>
<tr><td>*VP</td><td>VP address for restoring bitmap data.</td></tr>
<tr><td rowspan="2">0x06</td><td>Frame_Head</td><td>Frame header (2byte)</td><td rowspan="2">Send the current touched position to COM2 (serial port for reserving the system), the format is:
Frame_Head + X + Y + Check (The cumulative Sum for 1 byte of X, Y) + Frame_end.</td></tr>
<tr><td>Frame_End</td><td>Frame end (2byte)</td></tr>
</table>

3.1.10 Status sync-returned



Selected Area: (X, Y) are the top-left coordinates of icons.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

TP_ON_Mode: commands returned with once touch.

TP_ON_CONTINUE_Mode: commands returned with freezing touch.

TP_OFF_Mode: commands returned with touch released.

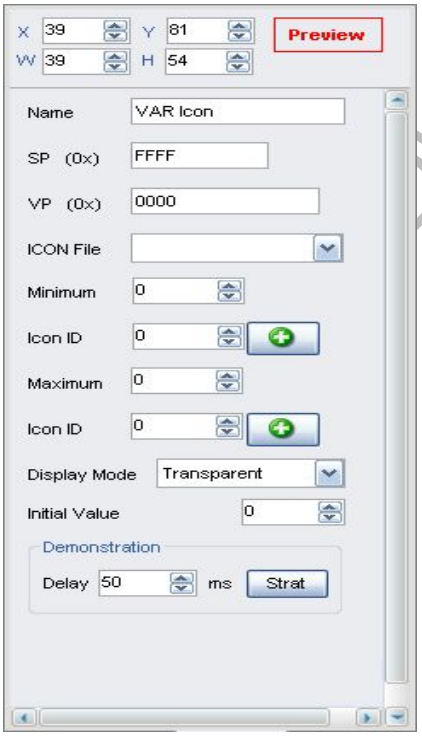
Status sync-returned mode

Add.	Definition	Data Length	description
0X00	Pic_ID	2	Picture ID
0X02	TP_Area	8	The selected button area
0X0A	Pic_Next	2	Switch to a new picture after pressing,0XFF:null.
0X0C	Pic_On	2	Picture ID for touching effect,0XFF:null.
0X0E	TP_Code	2	0XFE08
0X10	0xFE	2	0XFE
0X11	TP_ON_Mode	1	Commands returned with one touch: 0X00=no commands returned; 0X01=read LEN1 length data from VP1S , and write to VP1T variable adds; 0X02=read LEN1 length data from VP1S, and write to the serial port; 0X03=read LEN1 length data from VP1S, and write to VP1T register.
0X12	VP1S	2	Reading data adds of the first touch on the touch screen.

0X14	VP1T	2	Writing adds of the first touch on the touch screen.
0X16	0x00	1	0X00
0X17	LEN1	1	Length of the returning data(byte). 0X01=LEN1 must be an even number.
0X18	0xFE	1	0XFE
0X19	TP_ON_Continue_Mode	1	Commands returned with a freezing touch: 0X00=no commands returned; 0X01=read LEN2 length data from VP2S , and write to VP2T variable adds; 0X02=read LEN2 length data from VP2S , and write to the serial port; 0X03=read LEN2 length data from VP2S, and write to VP2T register.
0X1A	VP2S	2	Reading data adds of the freezing touch on the touch screen.
0X1C	VP2T	2	writing data adds of the freezing touch on the touch screen.
0X1E	0x00	1	0X00
0X1F	LEN2	1	Length of the returning data(byte). 0X01=LEN2 must be an even number.
0X20	0xFE	1	0XFE
0X21	TP_OFF_Mode	1	Commands returned with the button is released: 0X00=no commands returned; 0X01=read LEN3 length data from VP3S , and write to VP3T variable adds; 0X02=read LEN3 length data from VP3S , and write to the serial port; 0X03=read LEN3 length data from VP2S, and write to VP3T register.
0X22	VP3S	2	Reading data adds when a button is released.
0X24	VP3T	2	writing data adds of the freezing touch on the touch screen.
0X26	0x00	1	0X00
0X27	LEN3	1	Length of the returning data(byte). 0X01=LEN3 must be an even number.
0X28	0x00	8	Reserved,0x00 as d.

3.2 Variable Config.

3.2.1 Variable Icon



Selected Area: (X, Y) are the top-left coordinates of icons.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

Set SP to load description data into variable SRAM.

0xFFFF: load description data from configuration file.

VP: variable pointer.

ICON File: address of icon file.

Min/Max value: limits of variables, null if over limit.

Icon ID:

Icon address in icon file corresponding to the min/max value.

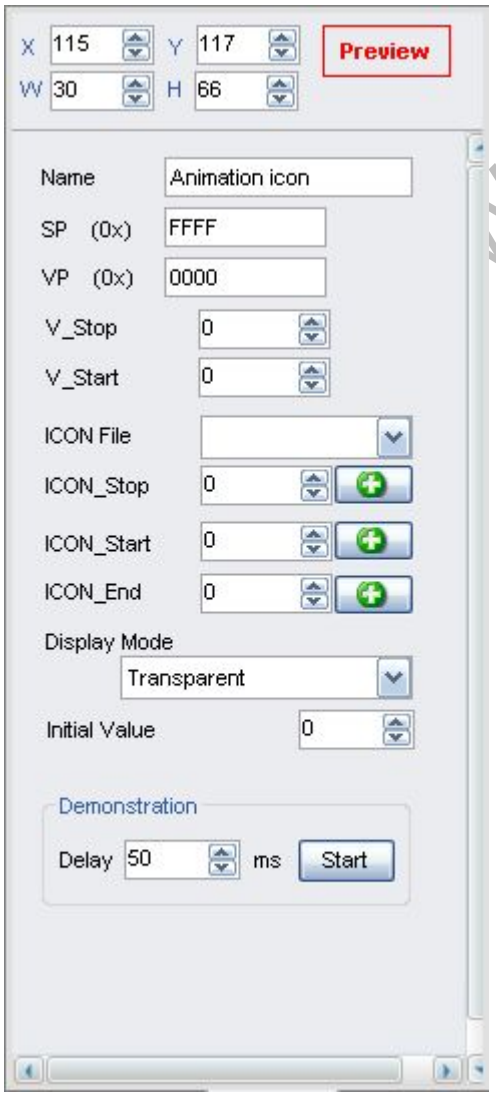
Display Mode: transparent/background.

Initial Value: Set the initial value & save it in the 22 config file,the system will be initiated according to 22 config file when the DGUS is started.

Illustration of variable <Variable Icon>:

Change the value in VP address to display different icons.

3.2.2 Animation Icon



Selected Area: (X, Y) are the top-left coordinates of icons.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

VP: variable pointer.

V_Stop: set value to stop animation.

V_Start: set value to start animation.

ICON File: address of icon file.

ICON Stop: icon at V_stop value.

Icon_Start/Icon_End:

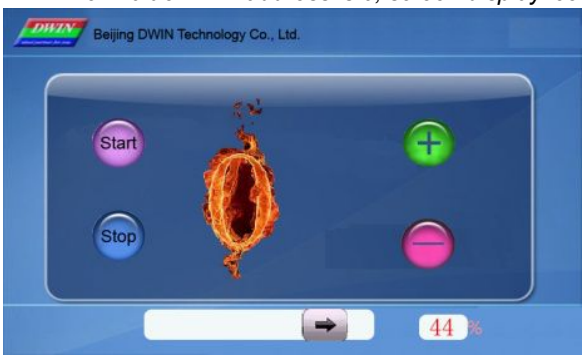
Start/end icon for animation at V_start Value.

ICON Display Mode: transparent/background.

Initial Value: Set the initial value & save it in the 22 config file,the system will be initiated according to 22 config file when the DGUS is started.

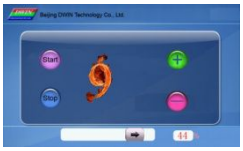
Illustration of variable <Animation Icon>:

When value in VP address is 0, screen display icon 0:

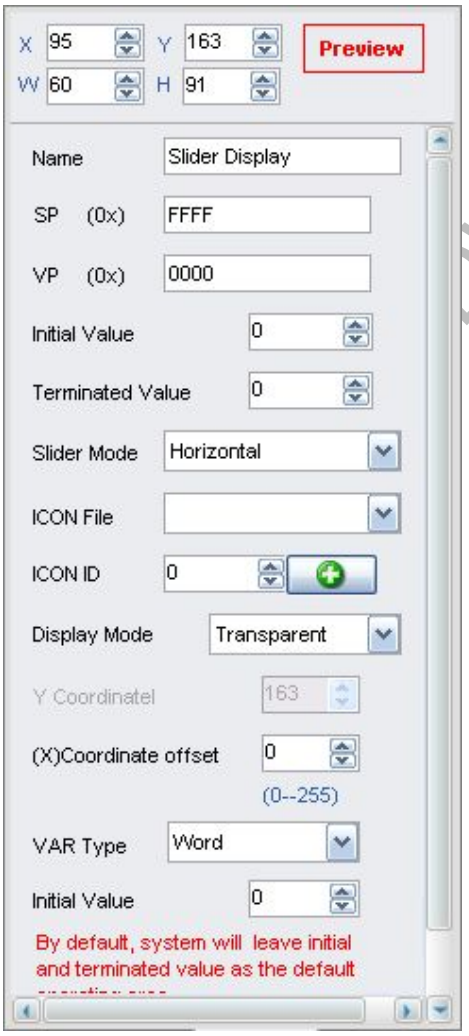


When value in VP address is 9, animation starts.


.....

.....


3.2.3 Slider



Selected Area: (X, Y) are the top-left coordinates of icons.

X, W is start/end point of horizontal slider.

Y, H is start/end point of vertical slider.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

VP: variable pointer.

Start/End Value: value corresponding to start/end point.

Slider Mode: horizontal/vertical.

ICON File: address of icon file.

ICON ID: icon address in icon file.

Display Mode: transparent/background.

Coordinate Offset:

Offset to the left/top.

VAR Type:

Integer (whole VP address).

High byte in VP address.

Low byte in VP address.

Initial Value: Set the initial value & save it in the 22 config file,the system will be initiated according to 22 config file when the DGUS is started.

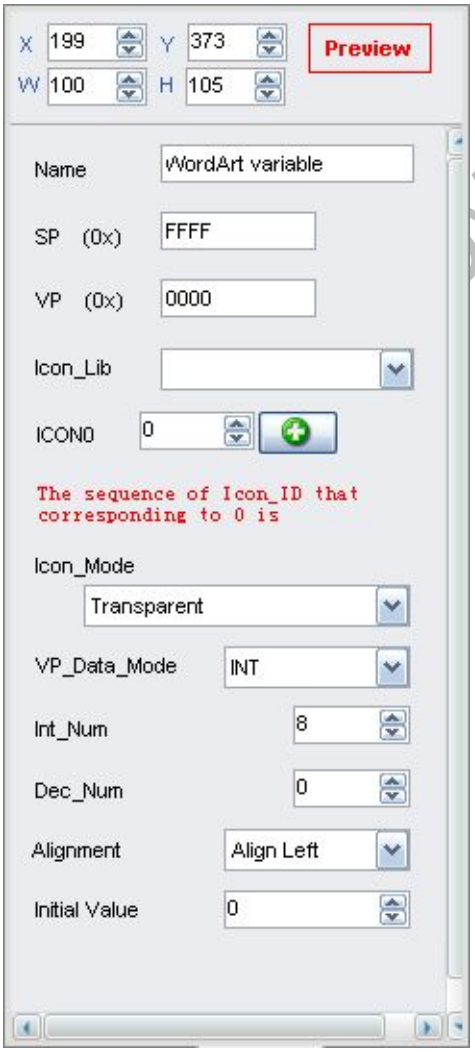
Note: Set same VP address for <Slider> button and <Slider display> variable to combine them.
<Slider display> is also used as progress bar.

Send command to serial port:

Frame header, Length, Command, VP, Data *string to display the Slider and Data above.*

A5 5A 05 82 000C 002C

3.2.4 WordArt



Selected Area: (X, Y) are the top-left coordinates of icons.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

VP: variable pointer.

ICON File: address of icon file.

ICON 0: icon address corresponding to number 0.

ICON Display Mode: transparent/background.

VAR Type: integer/long integer.

Number of INT/DEC bit: length of integer/decimal digits.

Initial Value: Set the initial value & save it in the 22 config file,the system will be initiated according to 22 config file when the DGUS is started.

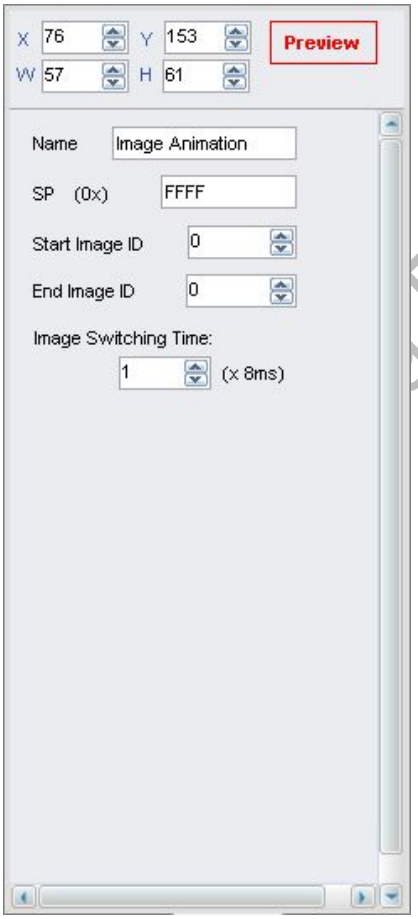
Illustration of variable <WordArt >:

Send command to serial port:

Frame header, Length, Command, VP, Data *string to display the WordArt above.*

A5 5A 05 82 0CCC 0017

3.2.5 Image Animation



Selected Area: (X, Y) are the top-left coordinates of icons.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

Start Image ID: select starting picture of animation.

End Image ID: select ending picture of animation.

Image Switching Time:

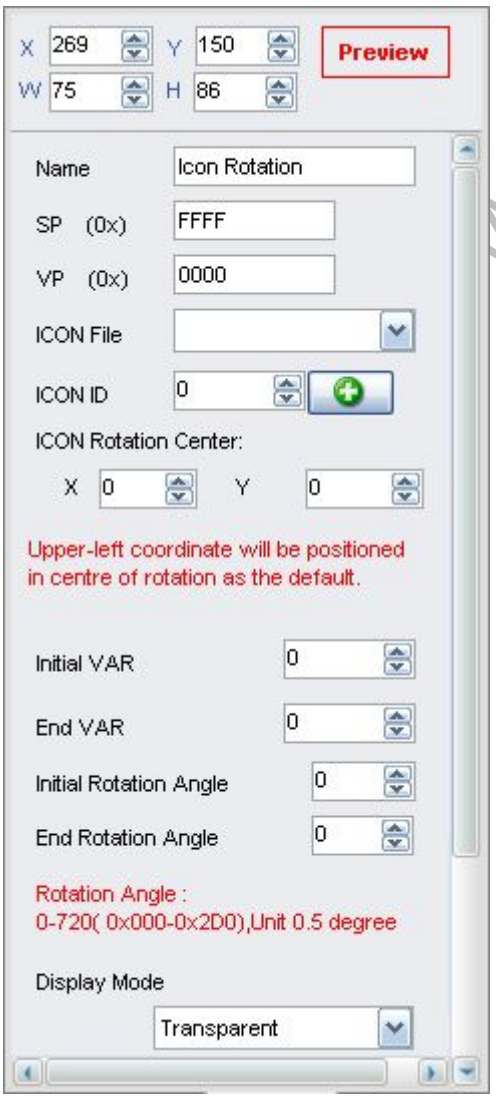
Select switching speed for animation, by every 8ms.

Start image ID should be less than end image ID.

Set a <image animation> on end image to loop.

Send commands or set <touch control> button to interrupt animation.

3.2.6 Icon Rotation



Selected Area: (X, Y) are the coordinates of rotating center.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

VP: variable pointer.

ICON File: address of icon file.

ICON ID: icon address in icon file.

ICON Rotation Center:

Select rotation center (X, Y) for the icon.

Initial/End VAR Value:

Value corresponding to start/end angle, null if over limit.

Initial/End Rotation Angle:

Select start/end angle, ranging from 0 to 720, by every 0.5° .

Display Mode: transparent/background.

VP_Mode:

Integer (whole VP address).

High byte in VP address.

Low byte in VP address.

Initial Value: Set the initial value & save it in the 22 config file,the system will be initiated according to 22 config file when the DGUS is started.

Send serial commands or press buttons to change value in VP address, and then to adjust the angle of pointer.

Illustration of variable <Icon Rotation >:

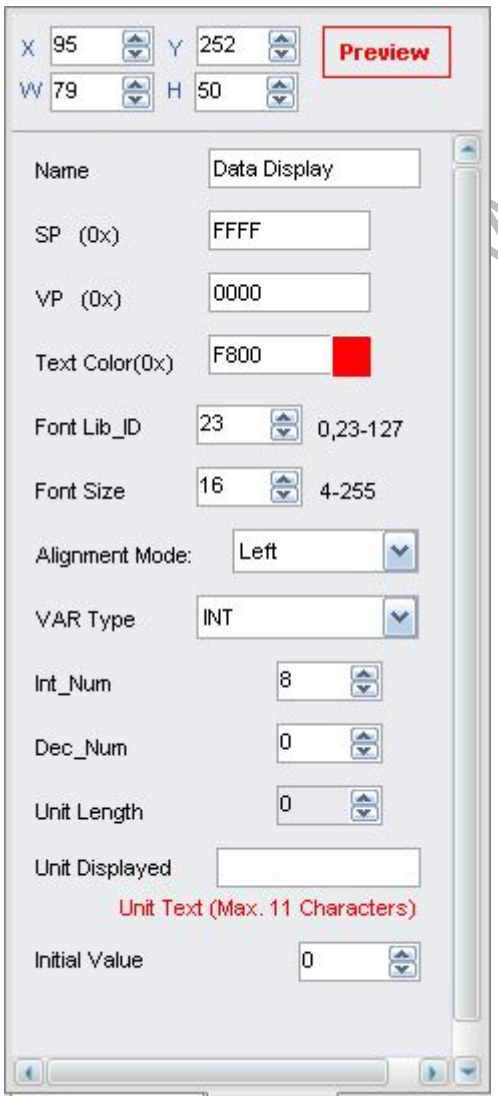
Icons file for rotation:

Send command to serial port:

Frame header, Length, Command, VP, Data *string to display the ICON above.*

A5 5A 05 82 000A 0084

3.2.7 Data Variable



Selected Area: (X, Y) are the top-left coordinates of data.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

VP: variable pointer.

Font Color: data color.

Font Lib_ID: address of ASCII font file.

Font Size: horizontal pixel numbers.

Alignment Mode: Right/Left /Centered.

VAR Type:

0x00: integer.

0x01: long integer.

0x02: high byte in VP address.

0x03: low byte in VP address.

Number of INT Bit: length of integer digits.

Number of DEC Bit: length of decimal digits.

Unit Length:

Corresponding to displayed unit automatically.

Unit Displayed:

ASCII unit for data, max length is 11 bytes.

Initial Value: Set the initial value & save it in the 22 config file,the system will be initiated according to 22 config file when the DGUS is started.

Send commands or set buttons to modify displayed data.

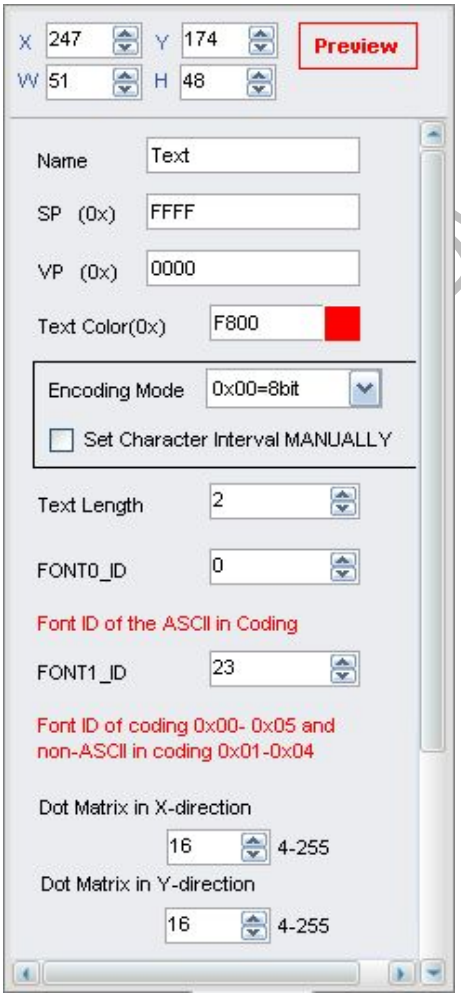
Illustration of variable <Data Variable>:

Send command to serial port:

Frame header, Length, Command, VP, Data *string to display the Data (left-up) above.*

A5 5A 05 82 0000 0022

3.2.8 Text Display



Selected Area: (X, Y) are top-left coordinates of data. Textbox is the selected area.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

VP: variable pointer.

Text Color: data color.

Encoding Mode:

0x00: 8bit encoding, 0x01: GB2312, 0x02: GBK, 0x03:BIG5, 0x05: UNICODE.

Set Character Interval MANUALLY: on/off.

Text Length: select text length, by byte.

Font0_ID: address of ASCII font file.

Font1_ID: address of non-ASCII font file.

Dot Matrix in X/Y-direction: select font size. Please note that parameter should be the same with the size of font file.

Horizontal/Vertical Separation:

Pixel distance in Horizontal/Vertical.

Initial Value: Set the initial value & save it in the 22 config file,the system will be initiated according to 22 config file when the DGUS is started.

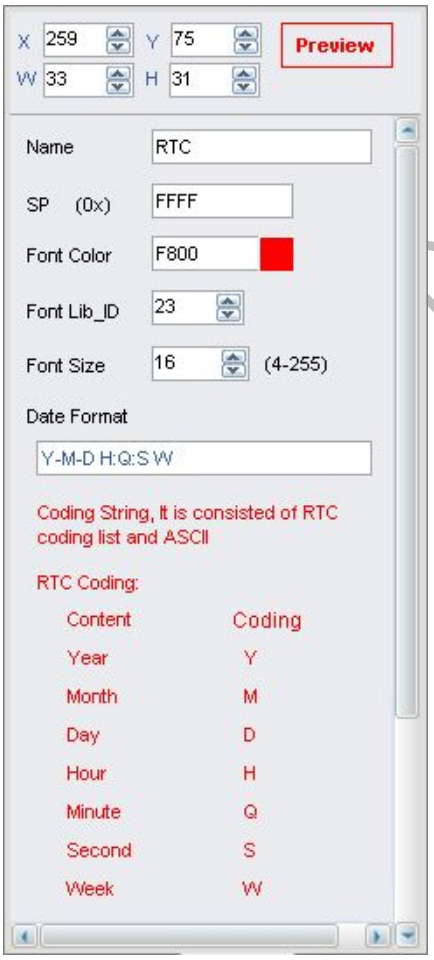
Illustration of variable <Text Display>:

Send command to serial port:

Frame header, Length, Command, VP, Data *string to display the Text (bottom-left) above.*

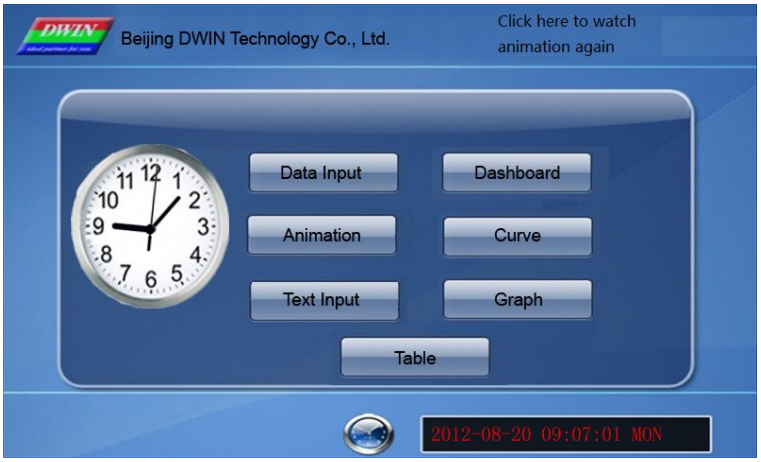
A5 5A 0D 82 0008 64 77 69 6E 20 64 67 75 73 76

3.2.9 Digital RTC Display

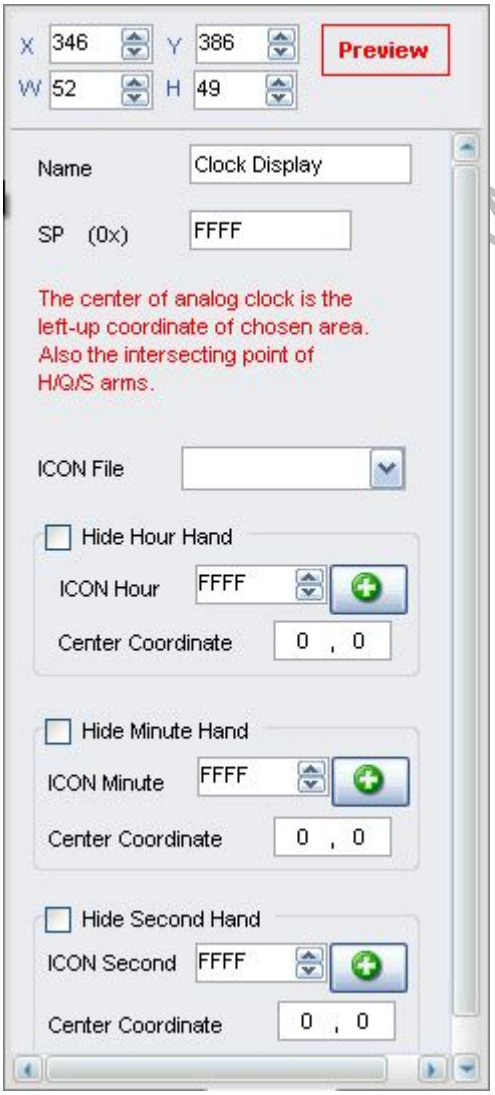


Selected Area: (X, Y) are the top-left coordinates of data.
Preview: preview VAR display effect.
Name: name this button for viewing it in .xls file.
SP: stack pointer, default setting is 0xFFFF.
Font Color: data color.
Font Lib_ID: address of ASCII font file.
Font Size: horizontal pixel numbers.
Date Format: refer to the red texts in picture in the left.
Use <RTC> button to modify current time.

Ilustration of variable <Digital RTC Display> (Digital clock on bottom-right of screen):

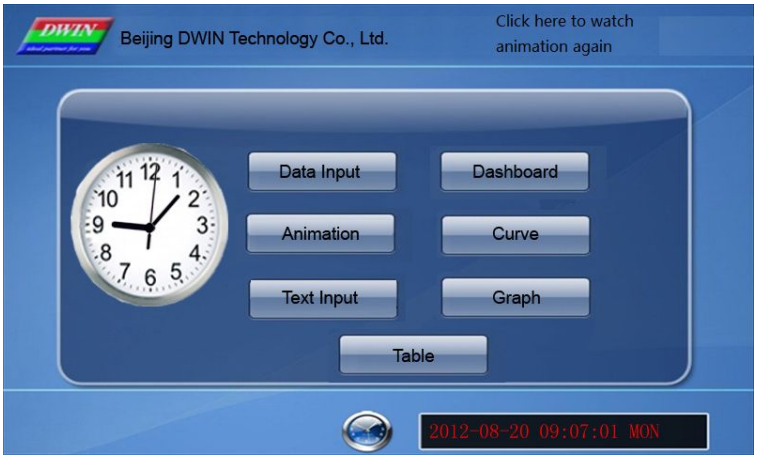


3.2.10 Analog Clock Display

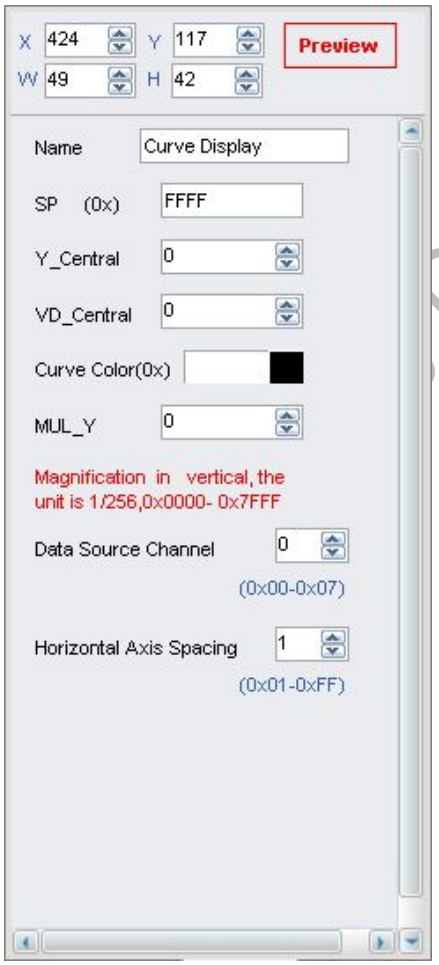


Selected Area: (X, Y) are the rotating center coordinates.
Preview: preview VAR display effect.
Name: name this button for viewing it in .xls file.
SP: stack pointer, default setting is 0xFFFF.
ICON File: address of icon file.
Analog Clock:
ICON Hour: select hour hand ID in icon file.
Center Coordinate: rotation center in icon.
Minute Hand:
ICON Minute: select minute hand ID in icon file.
Center Coordinate: rotation center in icon.
Second Hand:
ICON Second: select second hand ID in icon file.
Center Coordinate: rotation center in icon.
Use <RTC> button to modify current time.

Illustration of variable <Analog Clock Display>:



3.2.11 Dynamic Trend Curve



Selected Area: select window area, null if over range.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

Y_Central: select center line of trend curve.

VD_Central:

Trend curve value at center line, normally average of Max & Min value.

Curve Color: select color for trend curve.

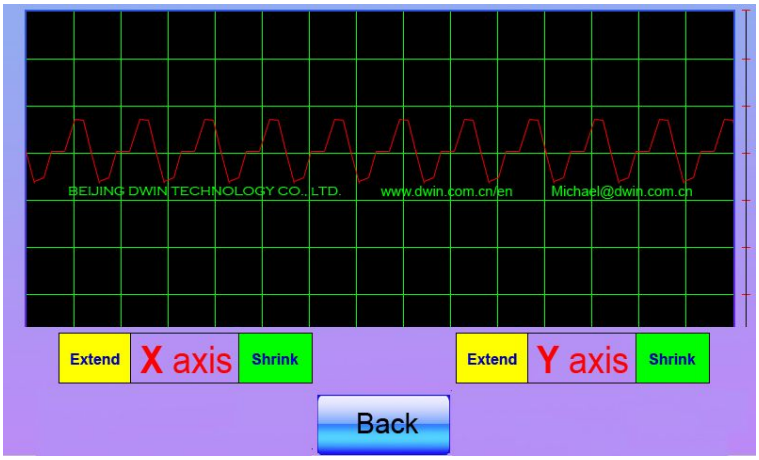
MUL_Y: magnification in Y direction, by every 1/256.

Data Source Channel: select channel for trend curve.

Horizontal Spacing:

Transverse spacing between sampling points.

Illustration of variable <Dynamic Trend Curve Display>:

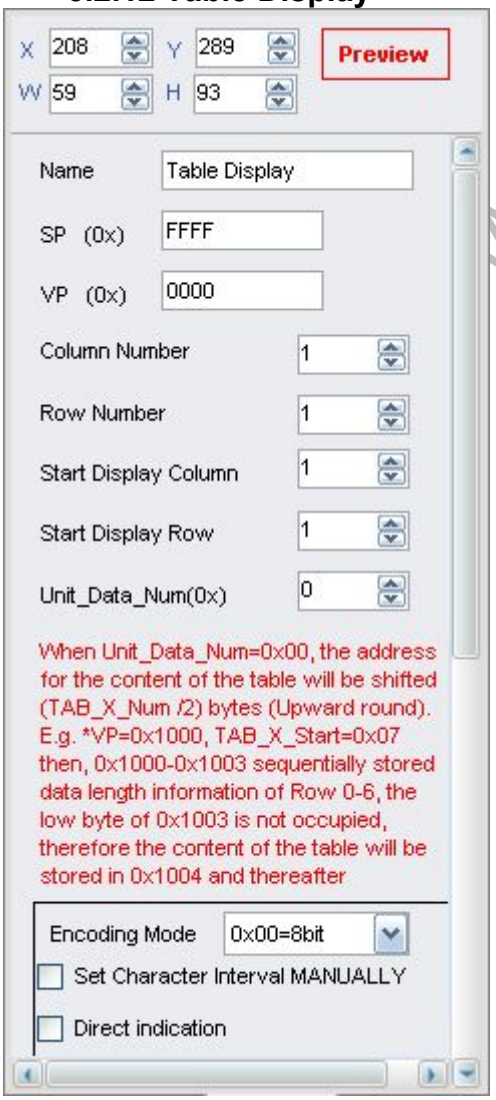


Send command to serial port:

Frame header, Length, Command, Data channel, Data *string to display the trend curve above.*

A5 5A 18 84 01 0800 0700 0710 0733 0800 0800 0800 0800 0900 0908 0906

3.2.12 Table Display



Selected Area: select table area, null if over range.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

VP: variable pointer, starting address of the data in table.

Column/Row Number: set the size of table.

Start Display Column/Row:

Select starting column/row to be displayed.

Unit_Data_Num:

0x01-0x7F: length of data for one cell.

0x00: data in VP address defines the length of each column.

When Unit_Data_Num is 00, starting address of data will be (Row number/2, round up to integer) backward from VP address.

Encoding Mode:

0x00: 8bit, 0x01: GB2312, 02: GBK, 03: BIG5, 04: SJIS, 05: UNICODE.

Set Character Interval MANUALLY: on/off.

Boarder Color: select table boarder color.

Text Color: select text color.

FONT0_ID: address of ASCII font file.

FONT1_ID: address of none-ASCII font file.

X/Y-Direction Size:

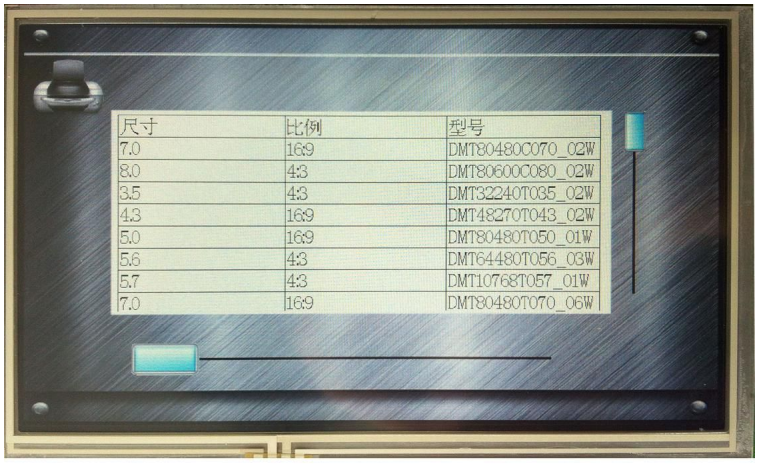
Select font size, accordant with width of fonts in font file.

Column Header: Valid Display/Invalid Display.

Row Header: Valid Display/Invalid Display.

Data for table can be loaded by 22.bin file. Refer to DGUS document for detailed instruction.

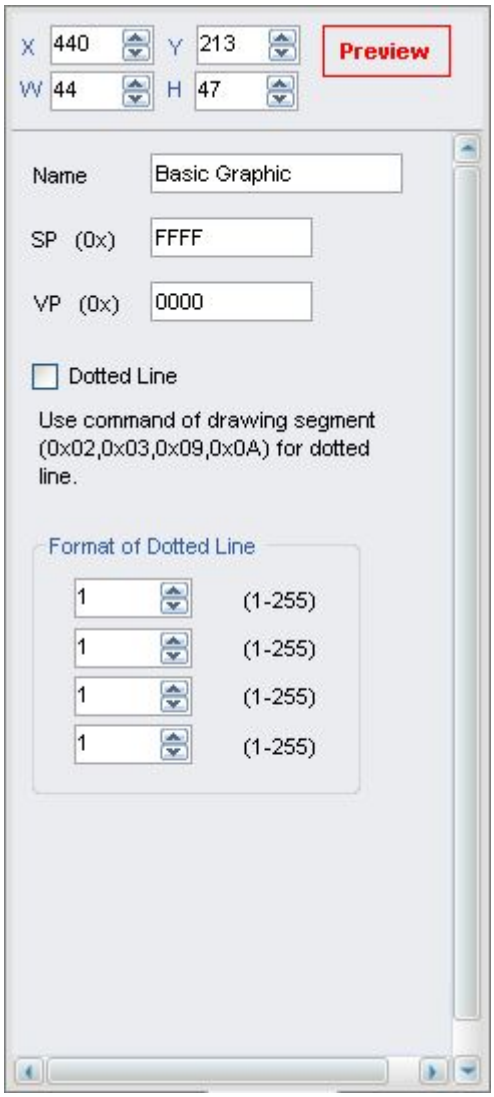
Illustration of variable <Table Display>:



If the length of data is shorter than designated, please use 0xFFFF as end mark of data in this cell.

For oversized table, users can use slider to pull the table.

3.2.13 Basic Graphic Display



Selected Area: select window area, null if over range. (Limit is only effective for 0x0001 - 0x0005 commands).

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

VP: variable pointer.

String Format

Address	Definition	Description
VP	CMD	Command
VP+1	Data_Pack_Num_Max	Data Pack Number
VP+2	DATA_Pack	

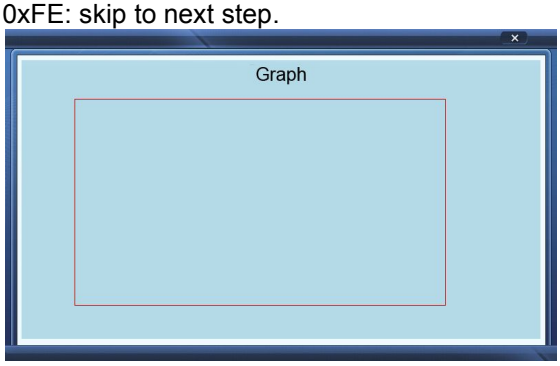
Data Pack for Basic Graphic

CMD	Function	Description of Data Pack Format, by word			
		Relative Address	Length	Definition	Description
0x0001	Dot	0x00	2	(x, y)	Dot coordinates.
		0x02	1	Color	Dot color.
0x0002	Line	0x00	1	Color	Line color.
		0x01	2	(x, y)0	Vertex 0 coordinates.
		0x03	2	(x, y)1	Vertex 1 coordinates.
		0x01+2*n	2	(x, y)n	Vertex n coordinates.
0x0003	Rectangle	0x00	2	(x, y)s	Top-left coordinates.
		0x02	2	(x, y)e	Bottom-right coordinates.
		0x04	1	Color	Rectangle's color.
0x0004	Rectangle Area Fill	0x00	2	(x, y)s	Top-left coordinates.
		0x02	2	(x, y)e	Bottom-right coordinates.
		0x04	1	Color	Filled color.
0x0005	Circle	0x00	2	(x, y)	Circle center coordinates.
		0x02	1	Rad	Radius of circle.
		0x03	1	Color	Circle color.
0x0006	Picture cut/paste	0x00	1	Pic_ID	Image ID of cutting area.
		0x01	2	(x, y)s	Top-left coordinates of the cutting area.
		0x03	2	(x, y)e	Bottom-right coordinates of the cutting area.
		0x05	2	(x, y)	Paste position on current screen.
0x**07	Icon Display	0x00	2	(x, y)	Top-left coordinates of icon.
		0x02	1	ICON_ID	Icon ID in icon file, high byte of command specifies address of icon file, display mode is transparent.
0x0008	Area fill	0x00	2	(x, y)	Sampling dot coordinates.
		0x02	1	COLOR	Filled color.
0x0009	Vertical line	0x00	1	Color0	Connect (X0, Y0s) (X0, Y0e) with color 0
		0x01	1	X0	
		0x02	1	Y0s	
		0x03	1	Y0e	

Judging condition:

0xFF: finish operation,

0xFE: skip to next step.



Send command to serial port:

Frame header, Length, Command, Address, Controlling bytes, Data pack, Coordinate, Color

A5 5A 11 82 20 00 00 03 00 01 00 64 00 64 02 8C 01 90 F8 00

To get the rectangle above.

3.2.14 Special Industrial Application

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

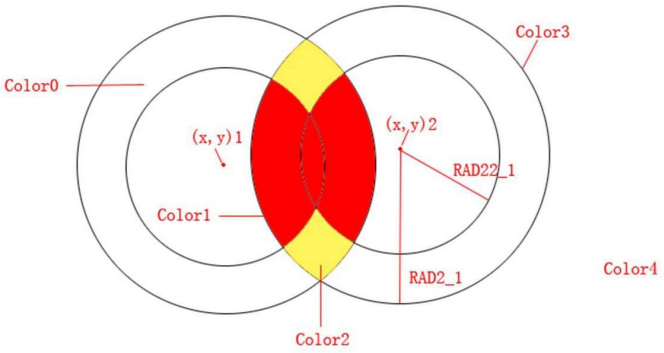
VP: variable pointer.

String Format

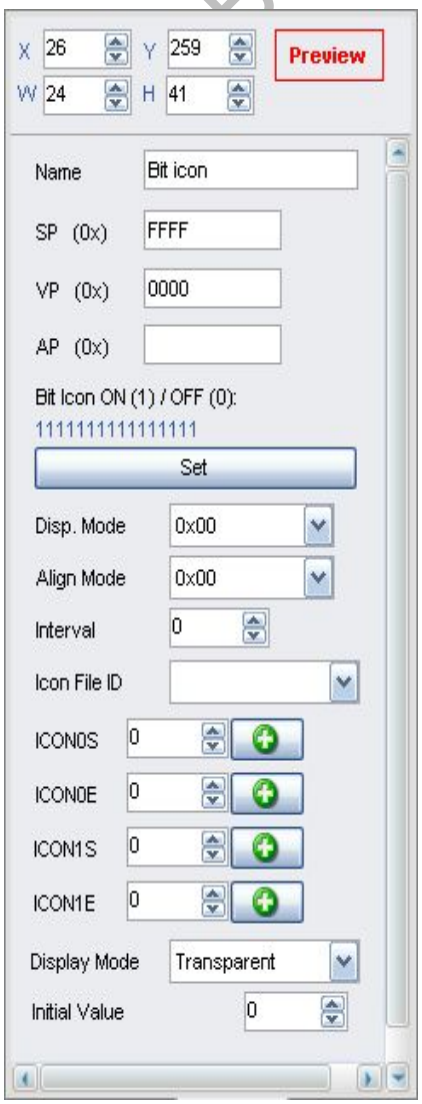
Address	Definition	Description
VP	CMD	Command
VP+1	Data_Pack_Num_Max	Data Pack Number
VP+2	DATA_Pack	

Data pack for Special Industrial Application

CMD	Function	Description of data pack format, by word			
		Relative Address	Length	Definition	Description
0x0001	Overlapped Area of Multiple Circles Fill	0x00	1	Color0	Color of “Safe Zone”.
		0x01	1	Color1	Color of normally overlapped area (Overlapped once).
		0x02	1	Color2	Color of High-Risk overlapped area (Overlapped twice or more).
		0x03	1	Color3	Color of circles.
		0x04	1	Color4	Color of evasion.
		0x05	4	Disp_Area	Display area, null if over range.
		0x09＋4*n	2	(x, y)n	Center coordinates of No. n.
		0x0B＋4*n	1	RADn_1	The bigger radius of No. n concentric circles.
		0x0C＋4*n	1	RAD2n_2	The smaller radius of No. n concentric circles.



3.2.15 Bit Variable Icon



Selected Area: (X, Y) are coordinates of top-left of icons.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

VP: variable pointer.

AP: substitutive variable pointer, reserved 2 words.

Bit Icon ON (1) /OFF (0): define BITs to display.

Disp. Mode: shown as the following table.

Align Mode:

0x00: X++, space unreserved for undesignated bits.
0x01: Y++, space unreserved for undesignated bits.
0x02: X++, space reserved for undesignated bits.
0x03: Y++, space reserved for undesignated bits.

Interval: spacing between icons.

Icon File ID: address of icon file.

ICON0S:

Icon ID for bit0 in non-animation mode, or starting

Icon ID for bit0 in animation mode.

ICON0E: ending icon ID for bit0 in animation mode.

ICON1S:

Icon ID for bit1 in non-animation mode, or starting
Icon ID for bit1 in animation mode.

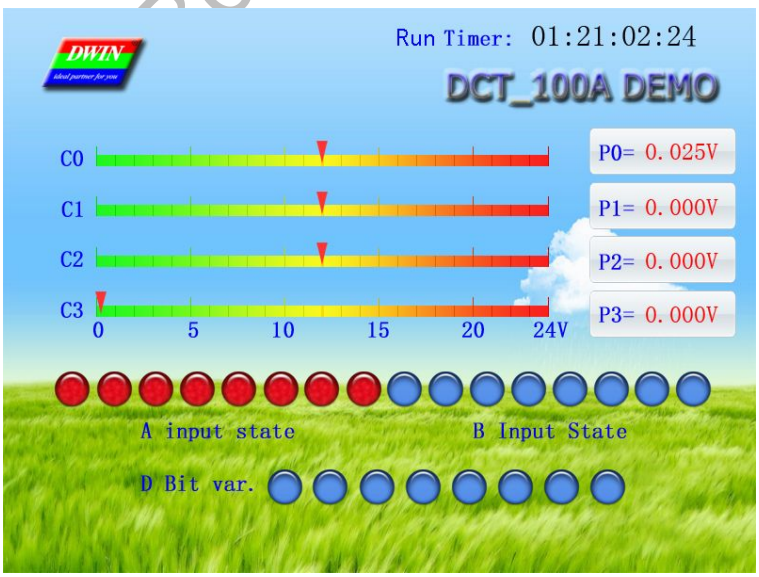
ICON1E: ending icon ID for bit1 in animation mode.

ICON Mode: Transparent/Opaque.

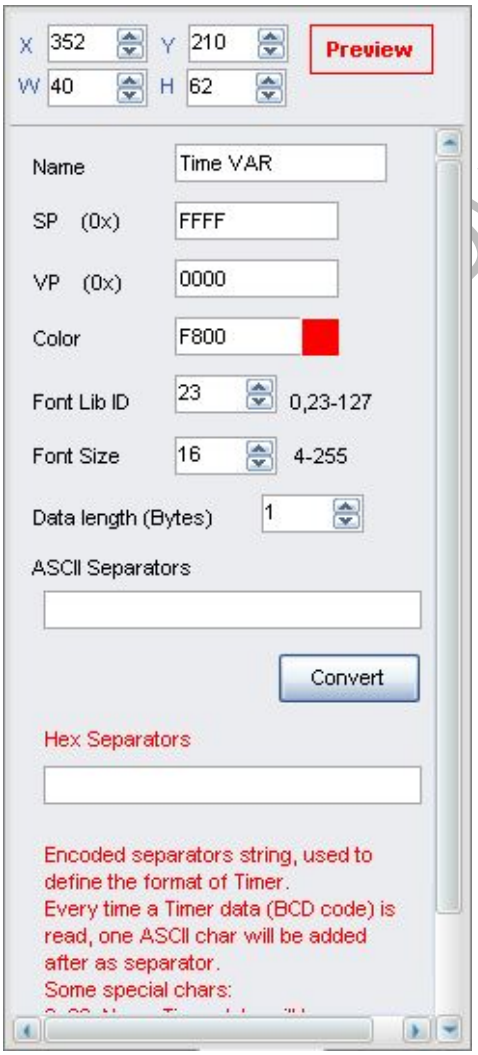
Initial Value: Set the initial value & save it in the 22 config file,the system will be initiated according to 22 config file when the DGUS is started.

Display_Mode	Value of bit	
	0	1
0x00	ICON0S	ICON1S
0x01	ICON0S	Null.
0x02	ICON0S	Animation: ICON1S - ICON1E.
0x03	Null.	ICON1S
0x04	Null.	Animation: ICON1S - ICON1E.
0x05	Animation: ICON0S - ICON0E.	ICON1S
0x06	Animation: ICON0S - ICON0E.	Null.
0x07	Animation: ICON0S - ICON0E.	Animation: ICON1S - ICON1E.

Illustration of variable <Bit Icon> (on bottom of screen):



3.2.16 Timer Variable



Selected Area: (X, Y) are the top-left coordinates of data.

Preview: preview VAR display effect.

Name: name this button for viewing it in .xls file.

SP: stack pointer, default setting is 0xFFFF.

VP: variable pointer.

Color: data color.

Font Lib ID: address of font file, 8bit encoding half-width.

Font Size: font size in X-direction.

Data length (Bytes): byte numbers to be displayed.

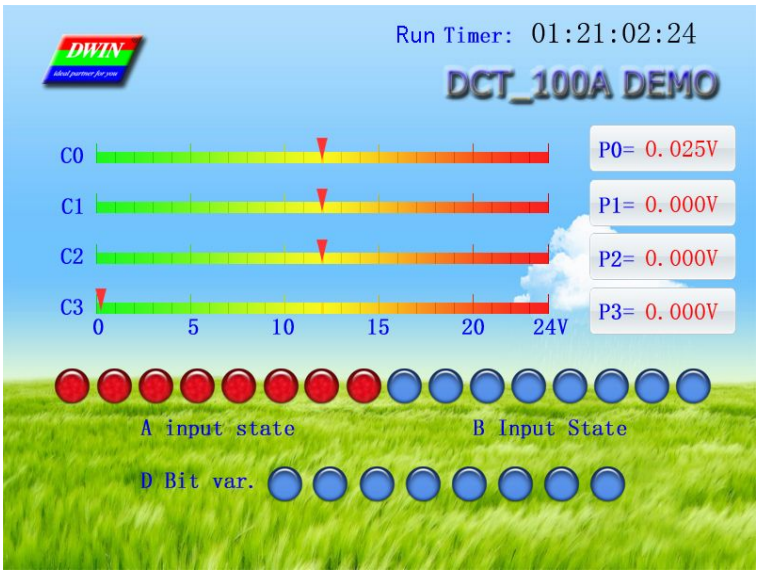
ASCII Separators: data string.

Convert: convert ASCII Separators into Hex Separators.

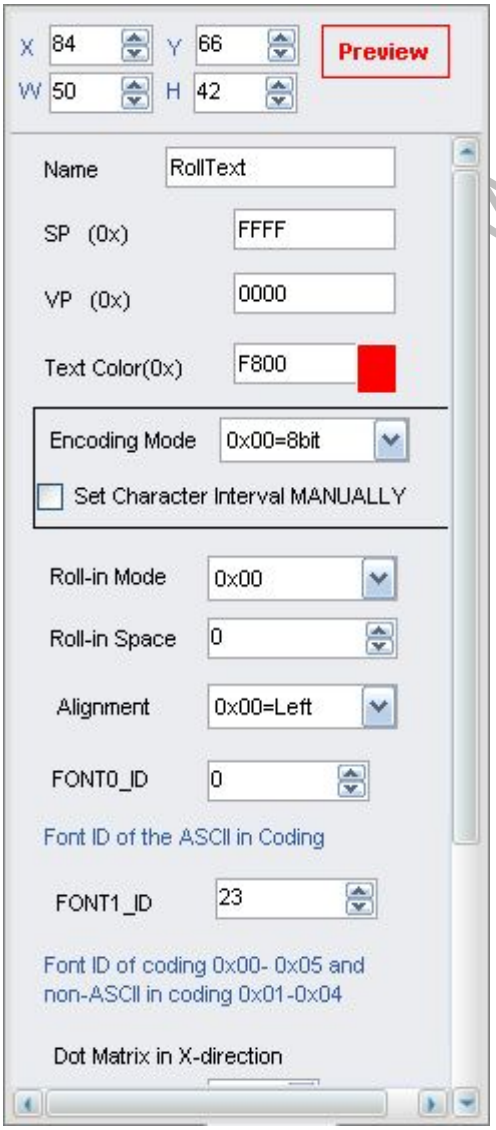
Encoded separators string, used to define the format of Timer. Every time a Timer data (BCD code) is read, one ASCII char will be added after as separator.

Some special chars: 0x00: none, Timer data will be concatenated; 0x0D: new line.

Illustration of variable <Bit Icon> (on top-right of screen):



3.2.17 RollText



Selected Area: (X, Y) are the top-left coordinates of data.
Preview: preview VAR display effect.
Name: name this button for viewing it in .xls file.
SP: stack pointer, default setting is 0xFFFF.
VP: variable pointer.
Text Color: data color.
Encoding Mode:
0x00: 8bit encoding,
0x01: GB2312,
0x02: GBK,
0x03:BIG5,
0x05: UNICODE.
Set Character Interval MANUALLY: on/off.
Roll-in Mode:
0X00=right to left
0X01=left to right
0X02=top to bottom
0X03=bottom to top
Roll-in Space: pixels to roll in each DGUS period.
Alignment: centered, left-aligned, right-aligned, top-aligned, button-aligned, equal width, equal height.
Font0_ID: address of ASCII font file.
Font1_ID: address of non-ASCII font file.
Dot Matrix in X/Y-direction: select font size. Please note that parameter should be the same with the size of font file.
Horizontal/Vertical Separation:
Pixel distance in Horizontal/Vertical.
Initial Value: Set the initial value & save it in the 22 config file,the system will be initiated according to 22 config file when the DGUS is started.

4. Commands

4.1 Data Frame

Serial data frame is constituted with 5 parts as shown in chart below:

Data Block	1	2	3	4	5
Definition	Frame header	Data length	Command type	Data string	CRC checksum
Data Length	2	1	1	N	2
Description	Defined by R3 and RA parameter in config.txt	Including command type, data string and CRC checksum	0x80-0x84		Enabled by R2 parameter in config.txt

4.2 Command Set

Function	CMD	Data	Description
Access Register	0x80	ADR(0x00-0xFF)+Data_Pack	Write data in particular address of register
	0x81	ADR(0x00-0xFF)+ RD_LEN(0x00-0xFF)	Read data in particular address of register
		ADR(0x00-0xFF)+RD_LEN+ Data_Pack	Response of DWIN LCD module
Access Variable SRAM	0x82	ADR_H:(0x0000-0x6FFF)+DATA0… +DATAn	Write data in particular address of variable SRAM
	0x83	ADR_H: L(0x0000-0x6FFF)+ RD_LEN(0x00-0x7F)	Read data in particular address of variable SRAM
		ADR_H: L+RD_LEN+DATA0……+ DATAn	Response of DWIN LCD module
Trend Curve Buffer	0x84	CH_Mode(Byte)+DATA0(Word)+…+ DATAn	Write trend curve buffer. CH_Mode defines the channels of data : ➢ Each bit in CH_Mode corresponds to one channel. ➢ CH_Mode. 0 corresponds to channel 0. ➢ Low channel ranges ahead. ➢ E.g.: CH Mode=0x83(10000011B), ➢ data format like "CH7+CH1+CH0"

Register is accessed by every byte, variable SRAM and trend curve buffer is accessed by word.

4.3 Register

Register, 256 bytes, is used for hardware operation and process control.

Register Address	Definition	Length (Byte)	Description
0x00	Version	1	DGUS version number, BCD code, 0x10 indicates V1.0.
0x01	LED_NOW	1	LED brightness, 0x00-0x40.
0x02	BZ_TIME	1	Buzzer beeping time, by every 10ms.
0x03	PIC_ID	2	Read: read current picture ID. Write: switch to specific picture ID.
0x05	TP_Flag	1	0x5A: there is update of touching area. Others= no updating. TouchPanel data is no longer updated if user did not clear the flag

			after data retrieving.
0x06	TP_Status	1	0x01: first click. 0x03: pressing down. 0x02: uplift pressing. Others: null.
0x07	TP_Position	4	Coordinate of touching position: X_H:L, Y_H:L.
0x0B	TPC_Enable	1	0x00: disable the touchPanel. Others: enable the touchPanel. Default setting: 0xFF.
0x0C-0x0F	Reserve	4	Undefined.
0x10-0x1A	R0-RA	11	Mapping of SD card config. register, read only.
0x1F	RTC_COM_ADJ	1	0x5A: RTC data is rewritten through serial port, cleared after RTC auto updating.
0x20	RTC_NOW	16	YY:MM:DD:WW:HH:MM:SS
Send serial command to modify current time, e.g.: A5 5A 0A 80 1F 5A 12 10 25 0412 00 01. “04” means Thursday, it can be written as any day you choose.			
0x30-0x3F	Reserve	16	Undefined.
0x40	En_Lib_OP	1	0x5A: applying writing in font flash memory, clear after operation.
0x41	Lib_OP_Mode	1	0x50: Transfer data from variable SRAM to font flash memory. 0xA0: Transfer data from font flash memory to variable SRAM.
0x42	Lib_ID	1	Designate font address for data exchange. Total space are 16MB, font space: 0x40-0x7F, maximum space of every font is 128KW.
0x43	Lib_Address	3	Designate address in font library for data exchange. Specified the first (word) address for data operation in font storage, 0x00:00:00-0x01:FF:FF.
0x46	VP	2	Designate variable SRAM addresses for data exchange. Specified the first (word) address for data operation in font storage, 0x00:00-0x6F:FF.
0x48	OP_Length	2	Length of exchanged data, by word.
Save 1KW variable data string starting from 0x1000 address into #64 font ID with starting 0x0000 address, send serial command: A5 5A 0C 80 40 5A 50 40 00 00 00 10 00 02 00.			
0x4A	Timer0	2	16-bit software timer, in term of 4ms, auto-decrement to 0.	Maximum error is +/_4ms.
0x4C	Timer1	1	8-bit software timer, in term of 4ms, auto-decrement to 0.	
0x4D	Timer2	1	8-bit software timer, in term of 4ms, auto-decrement to 0.	
0x4E	Timer3	1	8-bit software timer, in term of 4ms, auto-decrement to 0.	
0x4F	Key_code	1	Address of key code for 13 touch control config. file, 0x00: null. Clear after operation executed.	
0x50-0xFF	Reserve	182	Undefined.	

Register is accessed by command 0x80/0x81.

DGUS Register Space: 0x00H-0xFFH, is written / read by byte.

DGUS Variable Data Memory Space: 0x0000H-0x6FFFH, is written / read by word.

Data in Curve buffer is written / read by word.

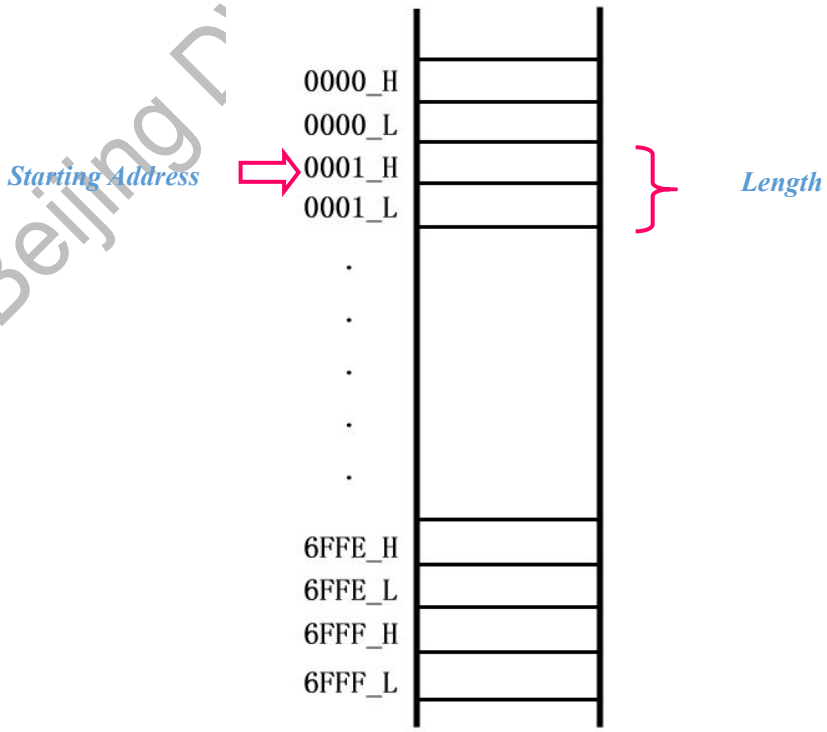
The communication between DGUS LCMs & Controllers (MCU) are driven by Variables that you may read and write in corresponding address.

4.4 VP & SP

4.4.1 VP (Variable Pointer)

4.4.1.1 About VP

VP is the initial address of variables in variable SRAM (56KB) which separated into 28672 pcs of memory spaces from 0x0000 to 0x6FFF occupying two bytes for each below. (High bytes and Low bytes)

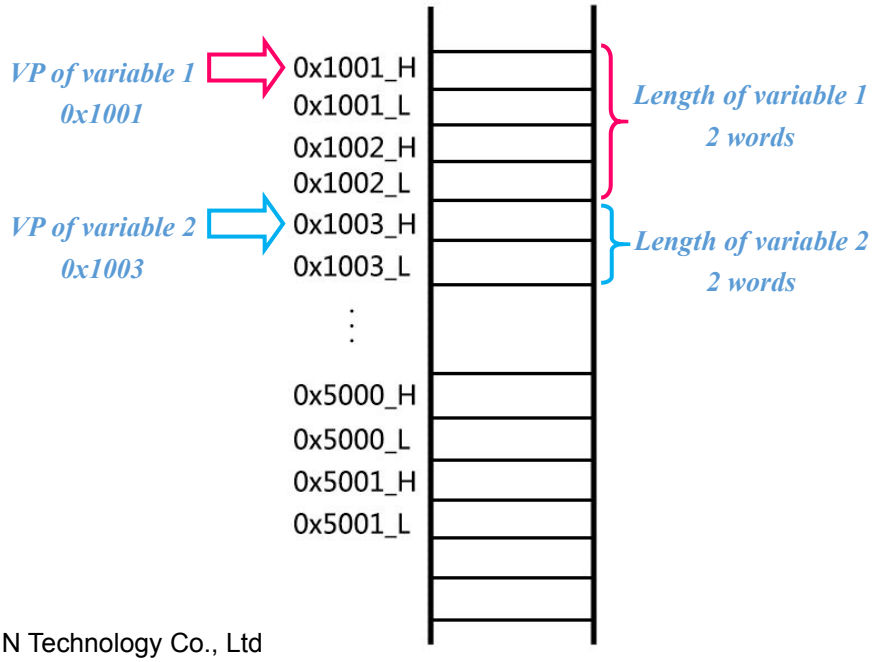


The communication between DGUS LCMs and host is oriented by variables that you may read or write in corresponding address. Reading &Writing of initial address and variable length could be changed via Command 0x82&0X83 if known in advance.

4.4.1.2 How to use VP?

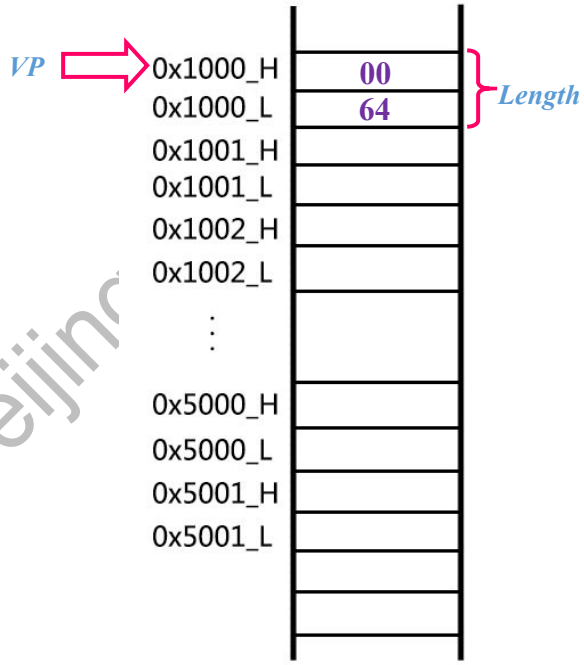
- ***Assign VP for each variables***

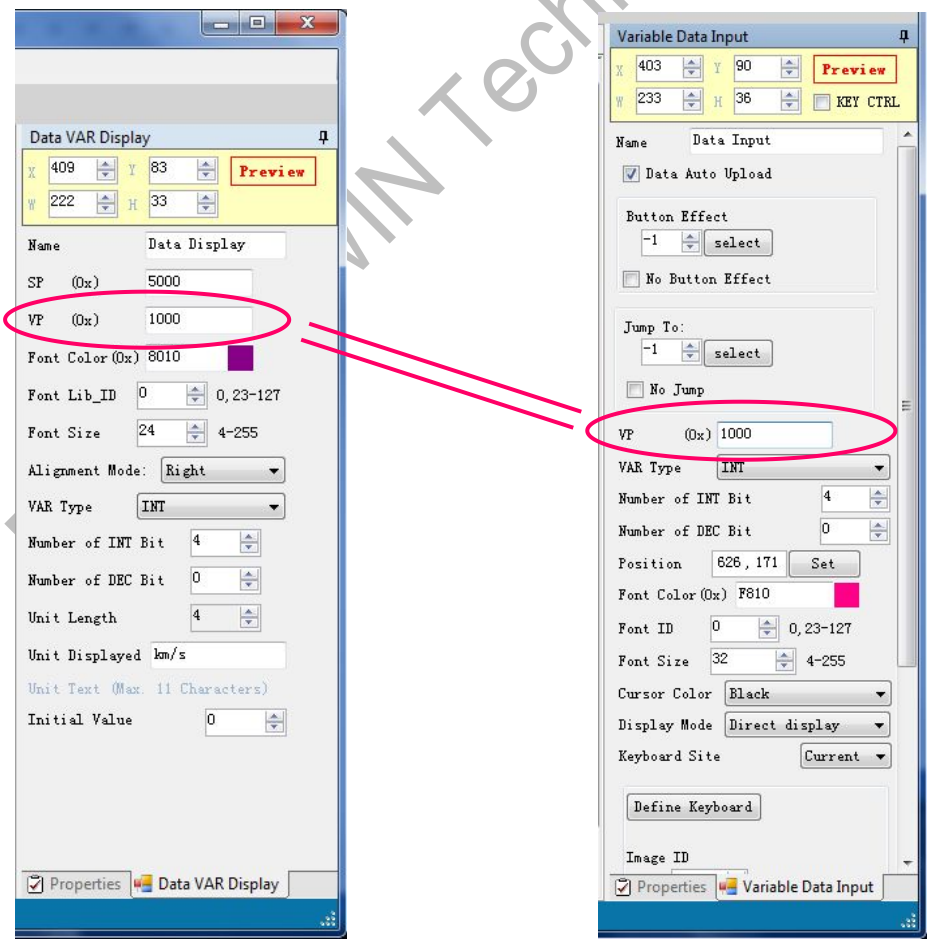
Each variable should be assigned a VP, yet overlap is not allowed. The value of the variable will be saved from the VP. For example, variable 1 as a long integer saved in 0x1001 while variable 2 as an integer have to be stored on another address preventing 0x1001 and 0x1002 from conflicts with variable 1.



➢ Set VP via DGUS_SDK

For example, display and input a variable (No. 100) which is an integer. The VP of this variable is 0x1000.





Supposing that reading & writing to the same one, touch and input parameters of VP should be the same accordingly.

4.4.2 SP (Stack Pointer)

4.4.2.1 About SP

SP is the initial address for saving variable attributes which described features of the variables, such as font color, font size and unit of variables, etc. The variable attributes refers to the Chapter Five of DGUS Dev. Guide.

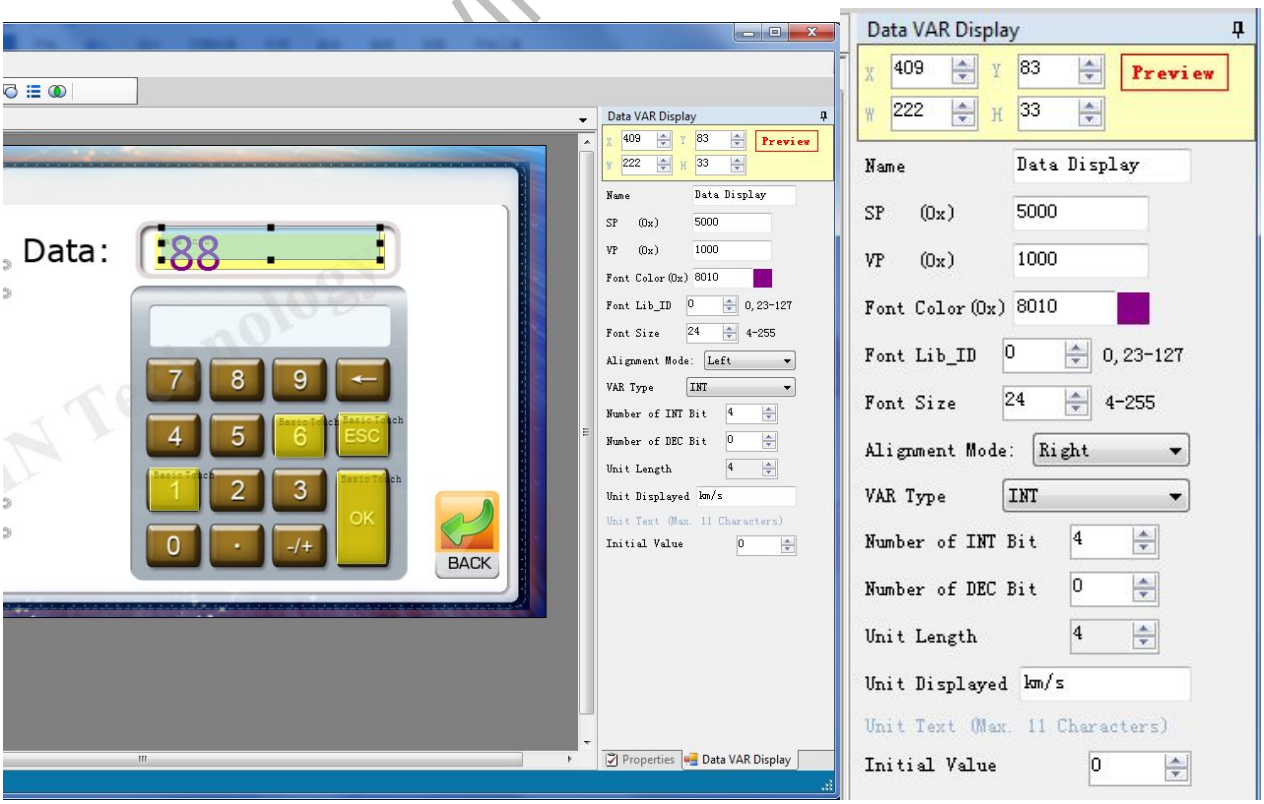
Address		Definition	Data Length	Description
0x00		0x5A10	2	
0x02		*SP	2	Stack pointer, default setting is 0xFFFF (set by Config. file).
0x04		0x000D	2	The whole process length (in terms of words).
0x06	0x00	*VP	2	Variable pointer.
0x08	0x01	X, Y	4	Top-left coordinate of text string.
0x0C	0x03	COLOR	2	Text color.
0x0E	0x04:H	Lib_ID	1	Address of font file.
0x0F	0x04:L	Font_X_Dots	1	Horizontal pixel numbers.
0x10	0x05:H	ALI	1	0x00: right-aligned, 0x01: left-aligned, 0x02: centered.
0x11	0x05:L	Int_Num	1	Length of integer digits. The sum should be less than 20.
0x12	0x06:H	Dec_Num	1	Length of decimal digits.
0x13	0x06:L	VP_Data_Mode	1	VP mode. 0x00: integer (2 bytes). -32768 – 32767 0x01: long integer (4 bytes). -2147483648 – 2147483647 0x02: high byte in VP address. 0 – 255 0x03: low byte in VP address. 0 – 255 0x04: double long integer (8 bytes). -9223372036854775808 – 9223372036854775807 0x05: unsigned integer (2 bytes). 0 – 65535 0x06: unsigned long integer (4 bytes). 0 – 4294967295
0x14	0x07:H	Len_unit	1	Length of unit. 0x00: without unit.
0x15	0x07:L	String_Unit	Max11	Unit data, by ASCII code.

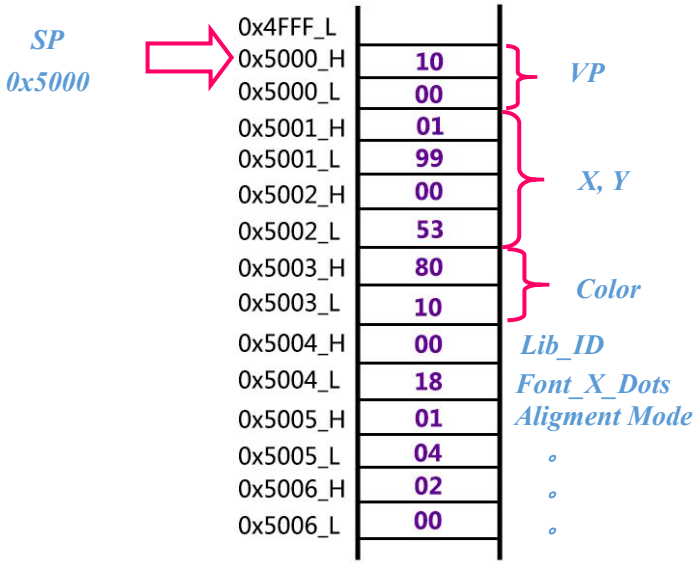
SP shares the same SRAM with VP from 0x0000 to 0x6FFF. It is only used for variable display but overlap exception.

4.4.2.2 How to use SP?

➢ *Set SP via DGUS_SDK*

Take “Data Display” as example:





➢ *Change variable attributes via SP*

Same sample as above：

In operation, if user attempts to do the changes on data color to red, just need able to write down a new value into corresponding address.

5.2.1 Data Variable (0x10)

Address		Definition	Data Length	Description
0x00		0x5A10	2	
0x02		*SP	2	Stack pointer, default setting is 0xFFFF (set by Config. file).
0x04		0x000D	2	The whole process length (in terms of words).
0x06	0x00	*VP	2	Variable pointer.
0x08	0x01	X, Y	4	Top-left coordinate of text string.
0x0C	0x03	COLOR	2	Text color.
0x0E	0x04:H	Lib_ID	1	Address of font file.
0x0F	0x04:L	Font_X_Dots	1	Horizontal pixel numbers.
0x10	0x05:H	ALI	1	0x00: right-aligned, 0x01: left-aligned, 0x02: centered.
0x11	0x05:L	Int_Num	1	Length of integer digits. The sum should be less than 20.
0x12	0x06:H	Dec_Num	1	Length of decimal digits.
0x13	0x06:L	VP_Data_Mode	1	VP mode. 0x00: integer (2 bytes). -32768 – 32767 0x01: long integer (4 bytes). -2147483648 – 2147483647 0x02: high byte in VP address. 0 – 255 0x03: low byte in VP address. 0 – 255 0x04: double long integer (8 bytes). -9223372036854775808 – 9223372036854775807 0x05: unsigned integer (2 bytes). 0 – 65535 0x06: unsigned long integer (4 bytes). 0 – 4294967295
0x14	0x07:H	Len_unit	1	Length of unit. 0x00: without unit.
0x15	0x07:L	String_Unit	Max11	Unit data, by ASCII code.

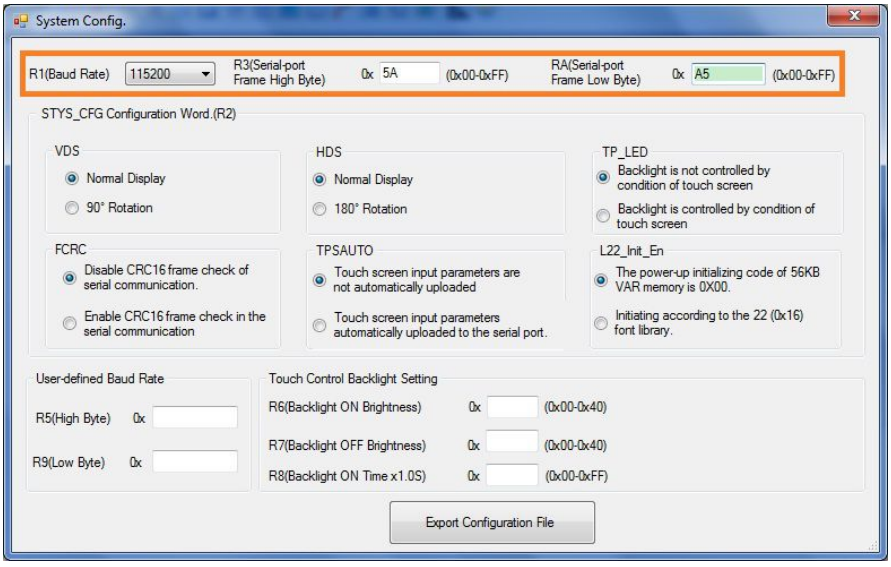
SP=0x5000

The color is saved in 0x5003

Frame header (2 Bytes)+Data length (1 Byte)+Command (1 Byte)+Data (N Byte: ADR+data/LEN)+CRC (2 Bytes, optional)
Send:5A A5 05 82 50 03 F8 00
Description: 5003: the address of color
F800: the value of red color

4.5 Examples

Configure frame header and baud rate in CONFIG.TXT via DGUS SDK as below:
R1=07
R3=5A
RA=A5

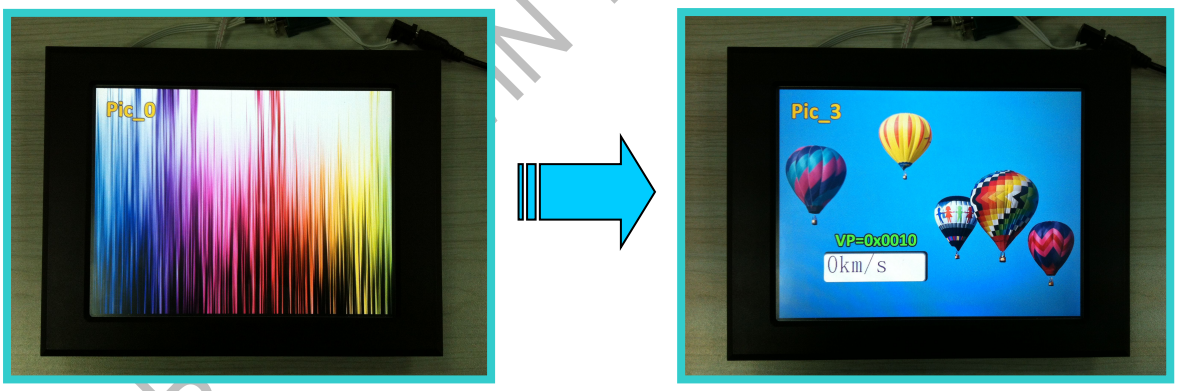


Frame header (2 Bytes)+Data length (1 Byte)+Command (1 Byte)+Data (N Byte: ADR+data/LEN)+CRC (2 Bytes)

4.5.1 Access Register of DGUS

4.5.1.1 Write Data into Register

Switch current picture to pic_3:



➢ **Register**

A 256B register is designed for hardware setting and process control. Refer to the table below:

Register Address	Definition	Length (Byte)	Description
0x00	Version	1	DGUS version number, BCD code, 0x10 indicates V1.0.
0x01	LED_NOW	1	LED brightness, 0x00-0x40.
0x02	BZ_TIME	1	Buzzer beeping time, by every 10ms.
0x03	PIC_ID	2	Read: read current picture ID. Write: jump to appointed picture ID. 0x5A: there is update of touching coordinates.
0x05	TP_Flag	1	Others= no updating. Touchpanel data is no longer updated if user did not clear the flag after data reading. 0x01: first click. 0x03: pressing down.

Send: 5A A5 04 80 03 00 03

Description: 03: Register for Picture ID

00 03: Appoint picture ID

4.5.1.2 Read Data from Register

Handshaking： Read DGUS version (V 5.7):

➢ **Register**

A 256B register is designed for hardware setting and process control. Refer to the table below:

Register Address	Definition	Length (Byte)	Description
0x00	Version	1	DGUS version number, BCD code, 0x10 indicates V1.0.
0x01	LED_NOW	1	LED brightness, 0x00-0x40.
0x02	BZ_TIME	1	Buzzer beeping time, by every 10ms.
0x03	PIC_ID	2	Read: read current picture ID. Write: jump to appointed picture ID. 0x5A: there is update of touching coordinates.

Send: 5A A5 03 81 00 01

Description: 00: Register for DGUS Version

01: Read data by a byte

4.5.1.3 Response from the DGUS module

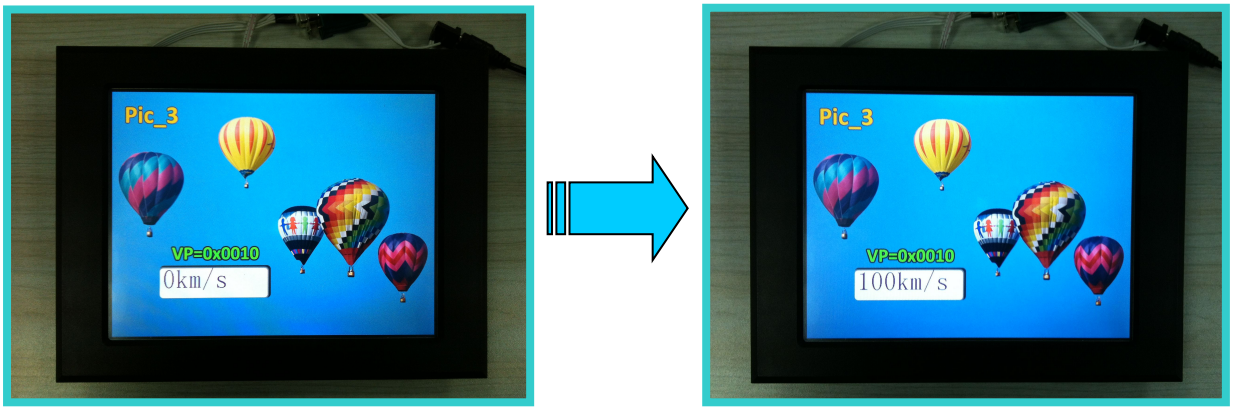
Receive: 5A A5 04 81 00 01 47

Description: 47: The version is 47 (V 4.7)

4.5.2 Access Variable SRAM

4.5.2.1 Write Data into variable SRAM

Write Data 100 to VP=0x0010



Send: 5A A5 05 82 00 10 00 64

Description: 0010: Variable pointer

0064:Data 100 in hexadecimal format

4.5.2.2 Read Data from variable SRAM

Send: 5A A5 04 83 00 10 01

Description: 0010: Variable pointer

01: Read data by a word

4.5.2.3 Response from the DGUS module

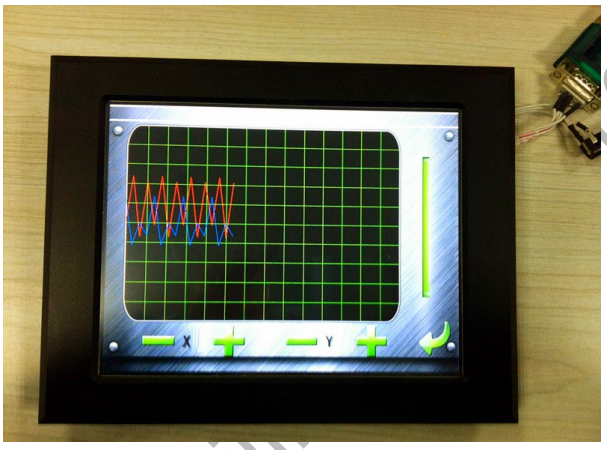
Receive: 5A A5 05 83 00 10 01 00 20

Description: 0020: Data 32 in hexadecimal format

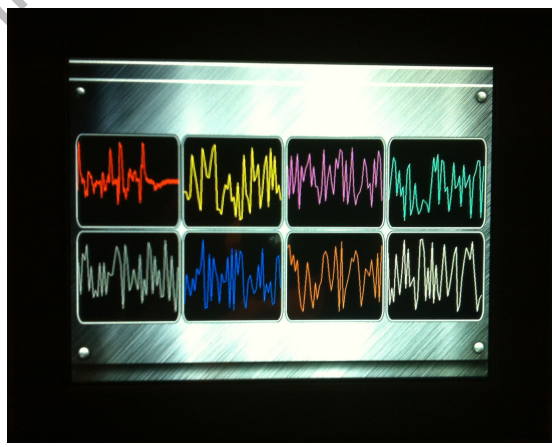
4.5.3 Dynamic Trend Curve Display

Send: 5A A5 12 84 12 00 32 00 72 00 9F 00 04 00 17 00 36 00 93 00 1A

Description: 12: Channel 4 & Channel 1, 8bit(0001 0010)



Display the trend curve in the same area



Display the trend curve in the different area simultaneously

4.5.4 Basic Graphic Display

String Format

Address	Definition	Description
VP	CMD	Command.
VP+1	Data_Pack_Num_Max	Max number of data packs. For command 0x0002, it's number of graph.
VP+2	DATA_Pack	

Date Pack For Basic Graphic

CMD	Function	Description of Data Format, by word			
		Relative Address	Data Length	Definition	Description
0x0001	Dot	0x00	2	(x, y)	Coordinate of dot.
		0x02	1	Color	Color of dot.
0x0002	Line	0x00	1	Color	Color of line.
		0x01	2	(x, y)0	Coordinate of vertex 0.
		0x03	2	(x, y)1	Coordinate of vertex 1.
		0x01+2*n	2	(x, y)n	Coordinate of vertex n.
0x0003	Rectangle	0x00	2	(x, y)s	Coordinate of top-left.
		0x02	2	(x, y)e	Coordinate of bottom-right.
		0x04	1	Color	Color of rectangle.
0x0004	Rectangle Area Fill	0x00	2	(x, y)s	Coordinate of top-left.
		0x02	2	(x, y)e	Coordinate of bottom-right.
		0x04	1	Color	Filled color.
0x0005	Circle	0x00	2	(x, y)	Coordinate of center of circle.
		0x02	1	Rad	Radius of circle.
		0x03	1	Color	Color of circle.
0x0006	Picture Cut/Paste	0x00	1	Pic_ID	Image ID of cutting area.
		0x01	2	(x, y)s	Coordinate of top-left of cutting area.

		0x03	2	(x, y)e	Coordinate of bottom-right of cutting area.
		0x05	2	(x, y)	Paste position on current screen.
0x**07	Icon Display	0x00	2	(x, y)	Coordinate of top-left of icon.
		0x02	1	ICON_ID	Icon ID in icon file, high byte of command specifies address of icon file, display mode is transparent.
0x0008	Area Fill	0x00	2	(x, y)	Coordinate of sampling dot.
		0x02	1	Color	Filled color.
0x0009	Vertical Line	0x00	1	Color0	Connect (X0, Y0s), (X0, Y0e) with color0.
		0x01	1	X0	
		0x02	1	Y0s	
		0x03	1	Y0e	
CMD	Function	Description of Data Format, by word			
		Relative Address	Data Length	Definition	Description
0x0001	Dot	0x00	2	(x, y)	Coordinate of dot.
		0x02	1	Color	Color of dot.
0x0002	Line	0x00	1	Color	Color of line.
		0x01	2	(x, y)0	Coordinate of vertex 0.
		0x03	2	(x, y)1	Coordinate of vertex 1.
		0x01+2*n	2	(x, y)n	Coordinate of vertex n.
0x0003	Rectangle	0x00	2	(x, y)s	Coordinate of top-left.
		0x02	2	(x, y)e	Coordinate of bottom-right.
		0x04	1	Color	Color of rectangle.
0x0004	Rectangle Area Fill	0x00	2	(x, y)s	Coordinate of top-left.
		0x02	2	(x, y)e	Coordinate of bottom-right.
		0x04	1	Color	Filled color.
0x0005	Circle	0x00	2	(x, y)	Coordinate of center of circle.
		0x02	1	Rad	Radius of circle.
		0x03	1	Color	Color of circle.
0x0006	Picture Cut/Paste	0x00	1	Pic_ID	Image ID of cutting area.
		0x01	2	(x, y)s	Coordinate of top-left of cutting area.
		0x03	2	(x, y)e	Coordinate of bottom-right of cutting area.
		0x05	2	(x, y)	Paste position on current screen.
0x**07	Icon Display	0x00	2	(x, y)	Coordinate of top-left of icon.
		0x02	1	ICON_ID	Icon ID in icon file, high byte of command specifies address of icon file, display mode is transparent.
0x0008	Area Fill	0x00	2	(x, y)	Coordinate of sampling dot.
		0x02	1	Color	Filled color.
0x0009	Vertical Line	0x00	1	Color0	Connect (X0, Y0s), (X0, Y0e) with color0.
		0x01	1	X0	
		0x02	1	Y0s	
		0x03	1	Y0e	

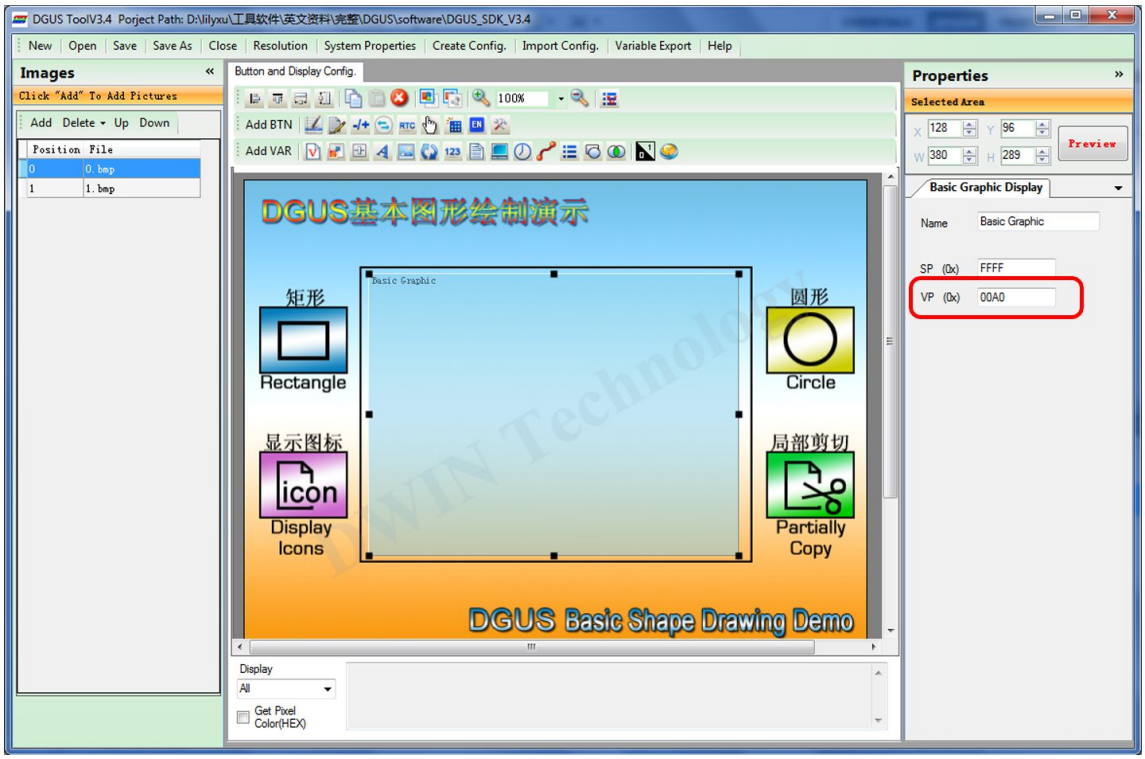
Status Flag:

0xFF Current drawing operation finished.

0xFE This operation will be skipped (ignored).

Take Circle Drawing for example

1) Add a basic graphic display via DGUS SDK software and set vp to 0x00A0 as below:



2) Send commands by serial port

0x0005	Circle	0x00	2	(x, y)	Circle center coordinates.
		0x02	1	Rad	Radius of circle.
		0x03	1	Color	Circle color.

Send: 5A A5 11 82 00 A0 00 05 00 01 01 64 00 EF 00 64 F8 00 FF 00

Hex	Description
5A A5	Frame header
11	Data length
82	Command
00 A0	VP
00 05	Circle command
00 01	One circle
01 64	X coordinate of center of circle:356
00 EF	Y coordinate of center of circle:239
00 64	Radius of circle:100
F8 00	Color: red
FF 00	Drawing operation finished